

iPhone 11 Overview

iPhone 11 is available in:

- Black
- Green
- Yellow
- Purple
- Red
- White



Features

iPhone 11 features:

- A13 Bionic chip with third-generation Neural Engine
- Liquid Retina HD display
- Dual 12MP Ultra Wide and Wide cameras
- 12MP TrueDepth camera
- Splash, water, and dust resistant
- 64GB, 128GB, and 256GB

In the Box:

- EarPods with Lightning Connector
- Lightning to USB Cable
- USB Power Adapter



1. Volume up/down buttons
2. Ring/Silent switch
3. Proximity sensor
4. Ambient light sensor
5. Receiver (stereo speaker) and microphone
6. Front camera
7. TrueDepth cameras
8. Side button
9. Microphone
10. Rear cameras
11. True Tone flash
12. Bottom microphones
13. Lightning connector
14. Stereo speaker

Service Considerations

- **Important:** Before servicing a device, ensure that the user has disabled Find My iPhone and removed any transit cards in Settings.
- **Two-Factor Authentication:** If performing a whole unit replacement for an iPhone that is a trusted device for two-factor authentication, do not erase the device until the user has set up a replacement iPhone.

Post-Repair Diagnostics: After a battery replacement the device must be configured with the new battery through System Configuration in AST 2.

Reset and Recovery Mode:

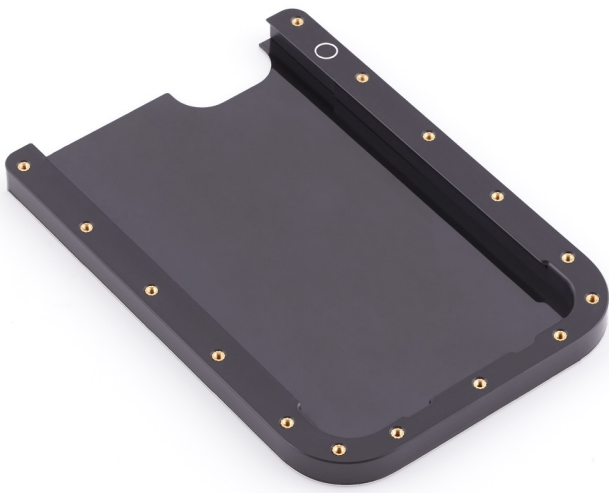
Reset: Press the Volume Up button. Then press the Volume Down button. Then press and hold the side button until the screen goes black and the Apple logo appears.

Recovery Mode: Plug the device into a computer with iTunes open. Press the Volume Up button. Then press the Volume Down button. Then press and hold the side button until the screen goes black and the recovery mode screen appears.

Stereo Speakers: The receiver and bottom speaker are used together as stereo speakers. The left and right sound channels are routed to the speaker or receiver based on the orientation of the iPhone.

New Tools and Fixtures

If the back cover is damaged, apply a 6.1-inch Back Protective Cover (923-03569), then place the iPhone in the 6.1-inch Support Frame (923-03575) before attempting to open the device.



Caution:

- An incorrect position or the use of other fixtures may damage the device.
- iPhone 11 displays are adhered to the enclosure. Fixtures that clamp the iPhone may damage the enclosure.

After opening the device, use the 6.1-inch Repair Tray (923-03571) to support it. The 6.1-inch Repair Tray is identified by a circle on the upper-right corner. iPhone 11 will only fit correctly in the appropriate repair tray.



Verify Backup of User Data

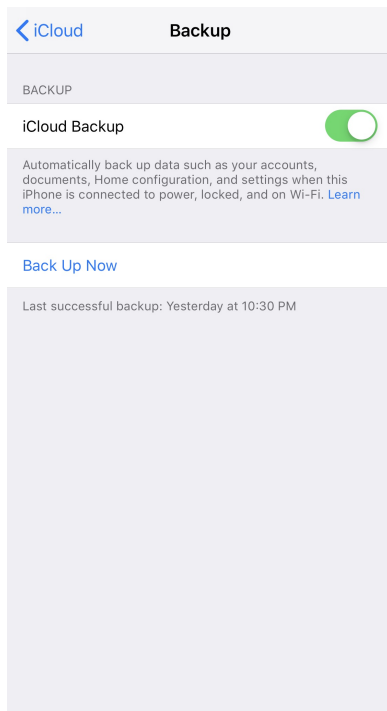
Verify Backup of User Data

Before troubleshooting a user's device, determine whether it is backed up with iCloud or iTunes.

iCloud Backup

An iCloud backup can be verified in one of the following locations:

- Choose Settings > Apple ID > iCloud > iCloud Backup



- Choose Settings > Apple ID > iCloud > Manage Storage > Backups



User data syncing to iCloud

Some important user data can sync to iCloud separately from a backup. If a device needs to be erased and set up as new for software troubleshooting, user data synced to iCloud can be downloaded to the device without the software issue returning.

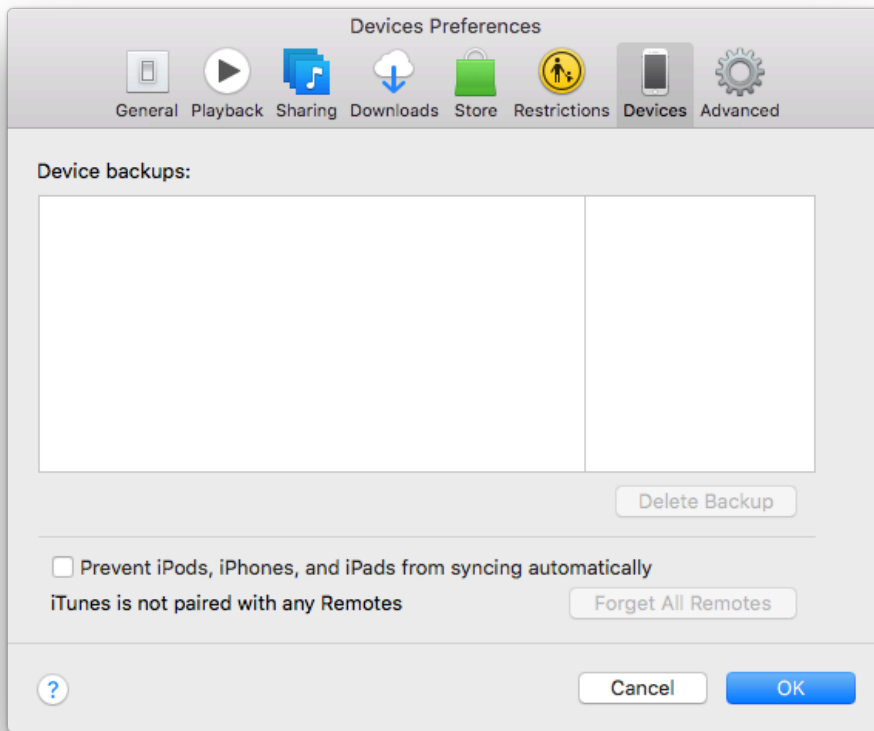
- Choose Settings > Apple ID > iCloud. Verify that any App containing data important to the user is syncing to iCloud.



iTunes on user's computer

1. Open iTunes on the user's computer.
2. Choose Preferences > Devices.
3. Verify the latest backup in the Device backups pane.

Important: To avoid syncing or backing up a user's device to a test computer, open iTunes, choose Preferences > Devices, and then select "Prevent iPods, iPhones, and iPads from syncing automatically."



Cleaning Procedures

Contents

This article includes the following sections:

- [Required Tools](#)
- [Dock or Lightning Connector \(iPhone, iPad, iPod\)](#)
- [Headphone Jack](#)
- [Speaker and Microphone](#)
- [Receiver \(iPhone\)](#)
- [Cleaning Putty \(iPhone\)](#)
- [SIM Tray](#)
- [Loop Holder \(iPod touch \(5th generation\)\)](#)

Required Tools

- Lighted otoscope (or lighted magnifying glass)
- ESD-safe brush (922-9918)
- ESD-safe tweezers
- Microfiber cloth
- Compressed air (for AirPods lightning connector only)
- Foam swab
- Isopropyl alcohol (IPA) wipe
- Nitrile gloves
- Cleaning putty (923-03045) (for iPhone only)



Caution: Never use compressed air to clean an iPhone, iPad, or iPod, as it can damage components.

Dock or Lightning Connector (iPhone, iPad, iPod)

Debris in the dock or Lightning connector can cause the following performance issues:

- Unable to charge battery.
- Device not recognized by computer or accessory.

Perform the following steps to clean the device:

1. Turn off the device.
2. Use a lighted otoscope or magnifying glass to inspect for debris.
3. Use an ESD-safe brush to delicately brush out debris. Be careful not to damage any metal contacts.
Note: Avoid brushing debris into the speaker or microphone on either side of the dock or Lightning connector.
4. Use ESD-safe tweezers to carefully remove any large pieces of debris. Be careful not to damage any metal contacts.



Headphone Jack

Debris in the headphone jack can cause the following audio or functional issues:

- Device is stuck in headphone mode and no audio is heard from receiver or speaker.
- Headphone audio is distorted (static or crackles) or is not functioning.
- Headphone audio is only heard in one channel.
- Headphone microphone has distorted sound or no sound.
- Headphone connector will not fully fit into the headphone jack.



Warning: Do not use long metal tools (such as screwdrivers or dental picks) to clean inside the headphone jack as this could puncture the battery.

1. Use a lighted otoscope or magnifying glass to inspect for debris.
2. Use an ESD-safe brush to brush out lint or debris. Use just enough bristles to fit inside the headphone jack. Twist the bristles to loosen and lift out debris.



Speaker and Microphone

Debris blocking the speaker and microphone openings can cause the following audio performance issues:

- Low or distorted volume audio from the speaker.
- Muffled, low volume, or distorted audio recorded from the microphone.

Cleaning Procedure:

1. Use an ESD-safe brush to gently brush cover openings of the speaker and microphone.

Note: Brush debris away from the connector to avoid brushing debris into the dock or Lightning connector.



Receiver (iPhone)

Debris blocking the receiver opening can cause the following audio performance issues:

- Muffled, low volume, or distorted audio through the receiver

Cleaning Procedure:

1. Inspect the receiver for loose debris.
2. Use an ESD-safe brush to gently brush the cover mesh in the receiver opening to remove debris.
Caution: Use extreme care to avoid damaging the microphone embedded within the receiver opening. Avoid using large sweeping motions across the glass, as this could lead to scratches.
3. Use a microfiber cloth to wipe away the loosened debris.



Cleaning Putty (iPhone)

Important: Cleaning putty is only for use on iPhone. Do not use cleaning putty on any other product. Cleaning putty is not intended to replace the ESD-safe brush. Before using cleaning putty, try cleaning the speaker, microphone, and receiver grilles with an ESD-safe brush as described in the cleaning procedures above.

Cleaning putty should only be used on an iPhone that fails the AST 2 Audio Diagnostic test after following the ESD-safe brush cleaning procedures. For more information about AST 2 for iOS, search for article title "AST 2 for iOS Reference Guide."

Note: This procedure can be performed in front of the customer.

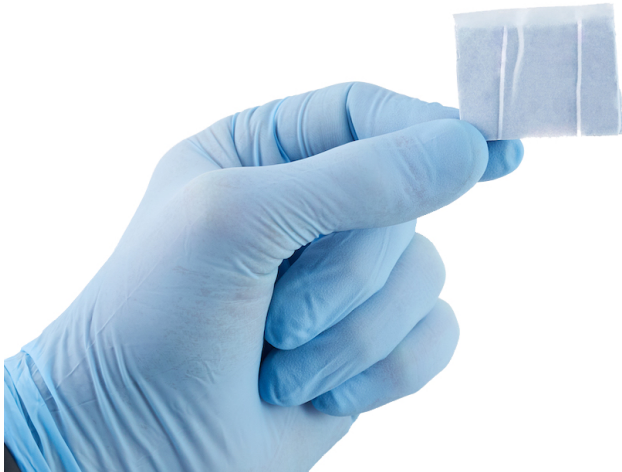
Debris blocking the speaker, microphone, or receiver grilles can cause audio performance issues such as:

- Low or distorted volume audio from the speaker and/or receiver.
- Muffled, low volume, or distorted audio recorded from the microphone.

Important:

- Cleaning putty is **only** for use on iPhone. **Do not use cleaning putty on any other product.**
- Do not use the same piece of cleaning putty on more than one device.
- Use the cleaning putty only as described in this procedure.
- Wear nitrile or lint-free gloves.
- Do not use excessive force. Pushing too hard into the speaker, microphone, or receiver grilles can cause damage to the device.

1. Remove the cleaning putty from the package.



2. Knead the cleaning putty until it is roughly 0.5-inch (1.3-cm) round.



3. Press the cleaning putty firmly into the speaker/microphone grille at the bottom of the iPhone.



4. Pull the cleaning putty directly away from the iPhone.
Important: Do not roll the cleaning putty off the iPhone. This could leave small amounts of cleaning putty in the openings.



5. Repeat the process **five times** for **both** the left and right speaker/microphone grilles.



6. Follow the same process to clean the receiver. Repeat the process **five times** for the receiver.





7. Follow the same process to clean the rear microphone. Repeat the process **five times** for the rear microphone.



8. Run the AST 2 Audio Diagnostic test again. If the iPhone fails the diagnostic test, use the same piece of cleaning putty and repeat the entire cleaning procedure. If the iPhone passes the Audio Diagnostic, discard the used piece of cleaning putty.

9. Use a microfiber cloth to clean away any loosened debris or residue.

SIM Tray

Dirt and debris around the SIM tray can cause the following issues:

- Difficulty opening or closing the SIM tray.
- Dirt and debris entering the device when SIM tray is ejected and removed.

1. Eject SIM tray from device.



2. Use an IPA wipe to gently wipe around edges of SIM tray to remove dirt from edges.
3. Use an IPA wipe to gently wipe around edges of SIM tray slot on device to remove dirt from edge.
4. Inspect the SIM tray to verify that dirt has been removed.
5. If any dirt still remains, repeat steps 2 and 3.



Loop Holder (iPod touch (5th generation))

Debris blocking the loop holder can cause the following functional issues:

- Loop holder does not respond to touch.
 - Loop holder does not open/close.
1. Use an ESD-safe brush to delicately brush out lint or debris. If needed, use ESD-safe tweezers to pull out any large pieces of lint or debris.



iPhone 6 and Later Accessories

Accessories included with iPhone 7 and later:

- Apple 5W USB Power Adapter
- Apple 18W USB-C Power Adapter (iPhone 11 Pro and iPhone 11 Pro Max only)
- EarPods with Lightning Connector
- Lightning to USB Cable (1 m)
- USB-C to Lightning Cable (iPhone 11 Pro and iPhone 11 Pro Max only)

Accessories included with iPhone 6, 6 Plus, 6s, 6s Plus:

- Apple 5W USB Power Adapter
- EarPods with 3.5 mm Headphone Plug
- Lightning to USB Cable (1 m)

Additional accessories (not included):

- Lightning to USB Cable (0.5 m)
- Lightning to USB Cable (2 m)
- Lightning to 3.5 mm Headphone Jack Adapter
- Lightning to 30-pin Adapter
- Lightning to 30-pin Adapter (0.2 m)
- Lightning to Micro USB Adapter (some countries)
- Lightning Digital AV Adapter
- Lightning to VGA Adapter
- Lightning to SD Card Camera Reader
- Lightning to USB Camera Adapter
- Lightning to USB 3 Camera Adapter
- iPhone Lightning Dock
- Leather Case*
- Silicone Case*
- [iPhone 6 / 6s Smart Battery Case](#)
- [iPhone 7 Smart Battery Case](#)
- [iPhone XR, iPhone XS, and iPhone XS Max Smart Battery Case](#)
- [AirPods](#)

*Service strategy for leather and silicone cases: Leather and silicone cases are available as out-of-warranty service parts.

Apple 5W USB Power Adapter

- Ultracompact design
- Fast, efficient charging



EarPods

- Built-in remote to adjust volume, control music and video playback, and answer or end calls
- Designed to rest comfortably inside a variety of ear sizes
- Speakers inside are designed to minimize sound loss and maximize sound output



Lightning to USB Cable

- USB 2.0
- Connects iPhone, iPad, or iPod (with Lightning connector) to a computer's USB port to sync and charge, or to a USB Power Adapter to charge from a wall outlet
- Reversible design



Lightning to 3.5 mm Headphone Jack Adapter

- Connects devices that use a 3.5 mm audio plug to a Lightning device
- Compatible with iPhone 5 and later using iOS 10 or later



Lightning to Micro USB Adapter

- Connects iOS devices with a Lightning connector to micro USB cables and chargers to sync and charge device



Lightning to 30-pin Adapter

- Connects devices with a Lightning connector to many 30-pin accessories*
- Supports analog audio output and USB audio, as well as syncing and charging
- Does not support video output

*Some 30-pin accessories are not supported.



Lightning to 30-pin Adapter (0.2 m)

- Connects devices with a Lightning connector to many 30-pin accessories*
- Supports analog audio output, USB audio, syncing, and charging
- Does not support video output

*Some 30-pin accessories are not supported.



Lightning Digital AV Adapter

- Supports mirroring of a device's screen to an HDMI-equipped TV, display, projector, or other compatible display in up to 1080p HD
- Requires an HDMI cable (sold separately) for connection to a TV or projector
- Supports both video and audio output



Lightning to VGA Adapter

- Supports mirroring of a device's screen to a VGA-equipped TV, display, projector, or other compatible display in up to 1080p HD
- Requires a VGA cable (sold separately) for connection to a TV or projector
- Does not support audio output



Lightning to SD Card Camera Reader

- Downloads photos and videos from a digital camera
- Supports standard photo formats, including JPEG and RAW, along with SD and HD video formats, including H.264 and MPEG-4
- Compatible with iPhone 5 and later

Note: The Lightning to SD Card Camera Reader supports data transfer up to USB 3 speeds on the 10.5-inch and 12.9-inch iPad Pro. All other iOS devices transfer at USB 2 speeds.



Lightning to USB Camera Adapter

- Downloads photos and videos from a digital camera
- Supports standard photo formats, including JPEG and RAW, along with SD and HD video formats, including H.264 and MPEG-4
- Compatible with iPhone 5 and later



Lightning to USB 3 Camera Adapter

- Transfers photos and videos from a digital camera
- Supports standard photo formats, including JPEG and RAW, along with SD and HD video formats, including H.264 and MPEG-4
- Compatible with iPhone 5 and later

Note: The Lightning to USB 3 Camera Adapter transfers data at USB 3 speeds when connected to a 10.5-inch and 12.9-inch iPad Pro. All other iOS devices transfer at USB 2 speeds.



iPhone Lightning Dock

- Connects iPhone to a computer to sync and charge, or to the Apple USB Power Adapter to charge from a wall outlet using a Lightning to USB Cable
- Features audio port that supports 3.5 mm headphones with remote control or line out
- Available in a variety of colors

- Compatible with iPhone 5 and later



Leather Case

- Leather exterior with soft microfiber lining
- Available in two sizes and a variety of colors



Silicone Case

- Silicone exterior with soft microfiber lining
- Available in two sizes and a variety of colors



Common Troubleshooting Procedures

When troubleshooting, attempt the common troubleshooting procedures in the order listed in the table below. Click the name of a quick fix procedure for detailed information.

Important:

- The following steps may not be effective for all issues. Apply only the steps necessary to isolate and resolve the user's issue.
- Before servicing a device, ensure that the customer has disabled Find My iPhone in Settings.

Procedure	Action
Update to Latest Software	<p>Go to Settings > General > Software Update, if available; or</p> <p>Use the latest version of iTunes (www.apple.com/itunes/download) to check for the latest iOS. Connect the device to the computer, open iTunes, select the device, click Summary, then click the Check for Update button.</p>
Charge Battery	<p>Connect to a known-good power outlet, using a known-good Apple USB Power Adapter and Lightning to USB Cable to charge the battery. Do not use a computer port or wireless charging to charge.</p> <p>Note: The device may have entered a deep discharge state that requires 20 to 30 minutes of charging to turn on. The charging screen should be visible after two minutes of charging.</p>
Force an App to Close	<p>iPhone X and later, iPad Pro 11-inch, and iPad Pro 12.9-inch (3rd generation):</p> <ol style="list-style-type: none">1. Swipe up from the bottom of the screen to see the App Switcher.2. Swipe the app's preview screen up to close the app. <p>iPhone 8 and earlier, iPad, and iPod touch:</p> <ol style="list-style-type: none">1. Double-click the Home button to see the App Switcher.2. Swipe the app's preview screen up to close the app.

Restart	<p>A restart forces the device to close all open files and turns off all hardware components.</p> <p>For all devices using iOS 11 or later:</p> <ol style="list-style-type: none"> 1. Choose Settings > General > Shut Down. 2. Drag your finger across the slider to turn off the device. 3. To turn on the device, press and hold the Sleep/Wake or side button until the Apple logo appears. <p>iPhone X and later, iPad Pro 11-inch, and iPad Pro 12.9-inch (3rd generation):</p> <ol style="list-style-type: none"> 1. Press and hold the Volume Down button and the side button until a slider appears. 2. Drag the slider to turn off the device. 3. To turn on the device, press and hold the side button until the Apple logo appears. <p>iPhone 8 and earlier, iPad, and iPod touch:</p> <ol style="list-style-type: none"> 1. Press and hold the Sleep/Wake or side button until a slider appears. 2. Drag the slider to turn off the device. 3. To turn on the device, press and hold the Sleep/Wake or side button until the Apple logo appears.
Reset	<p>Perform a reset only if you are unable to do a restart.</p> <ul style="list-style-type: none"> • iPhone 8 and later, iPad Pro 11-inch, and iPad Pro 12.9-inch (3rd generation): Press the Volume Up button. Then press the Volume Down button. Then press and hold the side button until the screen goes black. Finally, press and hold the side button until the Apple logo appears. • iPhone 7: Press and hold the side button and Volume Down button until the Apple logo appears. • iPhone 6s or earlier, iPad, and iPod touch: Press and hold the Sleep/Wake button and Home button until the Apple logo appears.
Erase All Content and Settings*	<p>Erases all user content and settings, including installed apps. From the Home screen, choose Settings > General > Reset > Erase All Content and Settings. If possible, try this before a restore because it is much faster.</p>
Restore*	<p>Erases all software and data and reinstalls iOS. Connect the device to the computer, open iTunes, select the device, click Summary, then click the Restore button.</p>
Recovery Mode Restore*	<p>Recovery mode loads only the firmware drivers necessary for iTunes to recognize the device. Click the link at left for instructions.</p>

***Caution:** Procedures will delete all user data and settings on the device. If saving content is important to the user, a backup should be made before beginning this process. If restoring user data from either an iCloud or iTunes backup causes an issue to return, there is no reason to restore from the other backup method as it will lead to the same result.

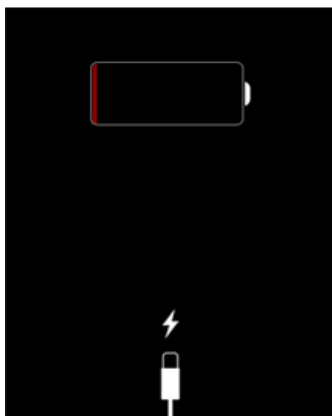
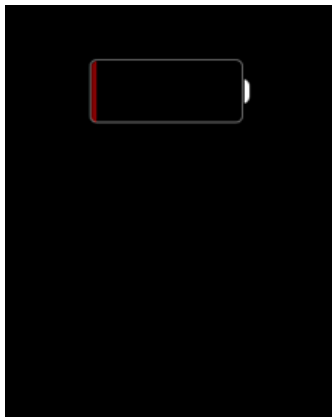
DF Reset and DFU Restore are not necessary to troubleshoot iOS devices. Restore and Recovery Mode Restore take less time to accomplish the same result. If the device will not go into Recovery Mode or will not charge, then follow the troubleshooting steps in the Service Guide.

Charge Battery

The device must have sufficient battery charge to proceed with troubleshooting. A low battery charge can cause many issues.

If the device has any of the following symptoms, connect it to the appropriate USB or USB-C Power Adapter to charge for at least 10 minutes:

- Will not turn on
- Black screen
- Charging screen
- Low battery charge



Note: If the device is extremely low on power, the display may be blank for up to two minutes before the low-battery image appears. To sufficiently charge the battery, use the device-appropriate Apple USB Power Adapter, because it delivers more power than the USB ports of some computers. Once the device has started up to the lock screen, it can be disconnected from the power adapter and connected to a computer.


If troubleshooting or testing will be performed without the device connected to power, make sure the device has a sufficient charge before continuing.

Important:

- Before connecting any cable to the dock connector, Lightning connector, USB-C, or headphone jack, check the ports for debris, contamination, corrosion, liquid, or damage. Clean or remedy these issues before connecting any cables.
- If the device becomes too hot while charging, disconnect and replace the device.
- Only use a known-good Apple USB Power Adapter with an Apple Lightning to USB Cable when charging from a power outlet. While other power adapters may appear to be compatible, their lower power output is not sufficient to charge the device.
- The battery icon in the status bar shows the battery charging status and approximately how much charge is left in the battery. When the device is connected to a power source, a lightning bolt appears beside the battery icon.

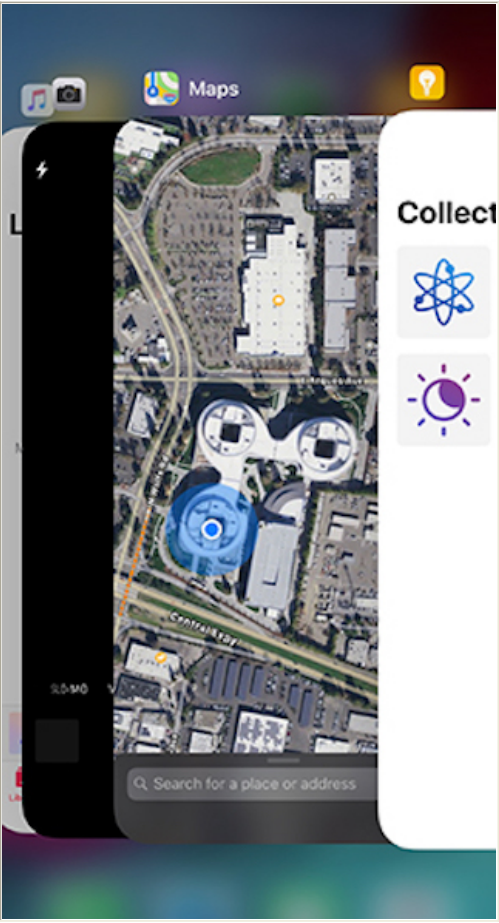
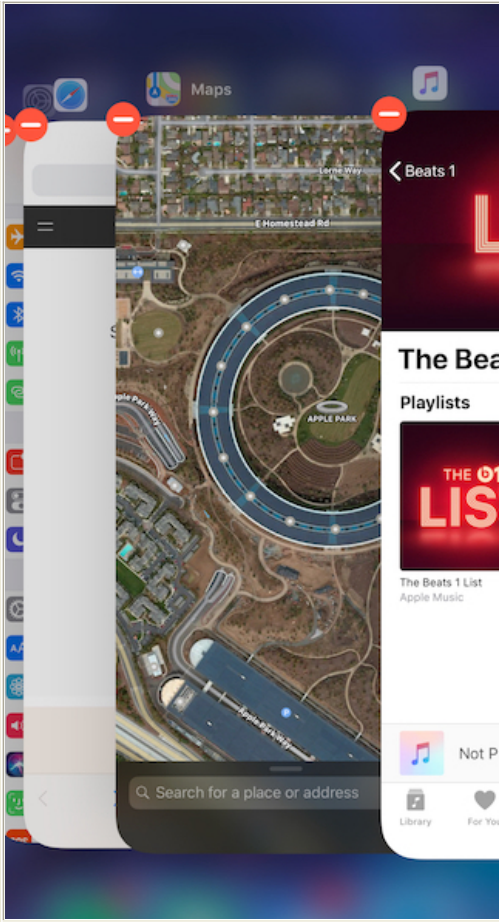


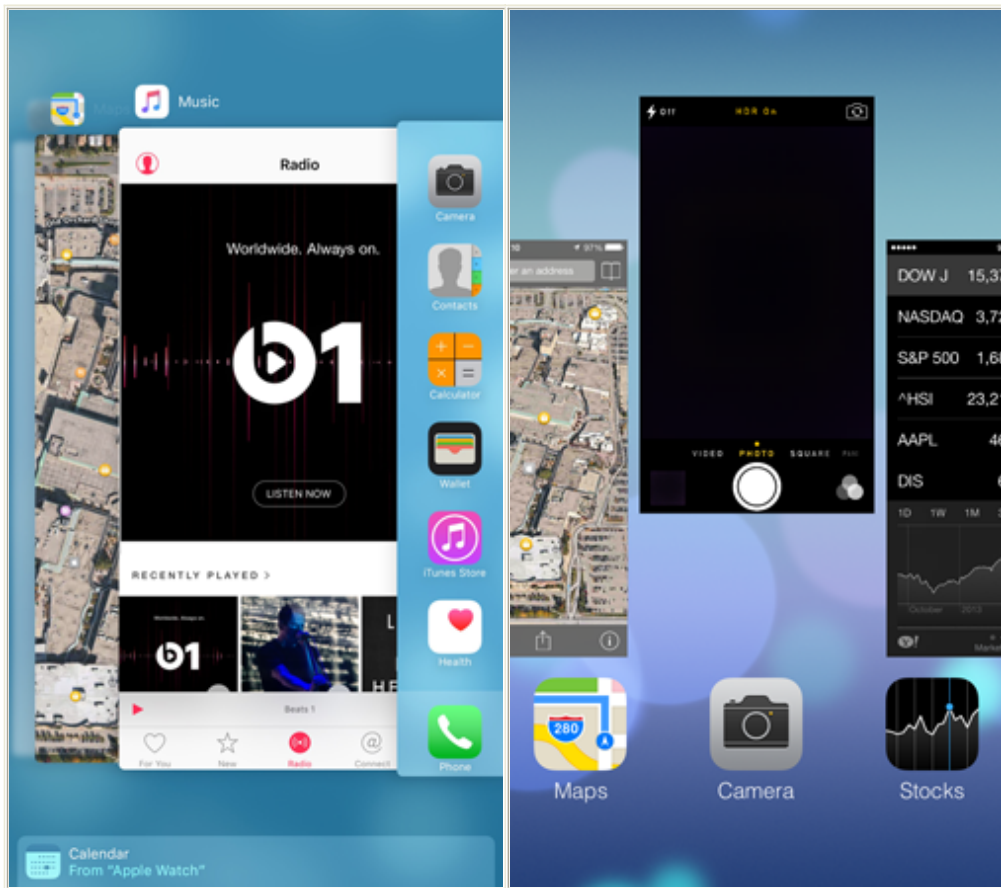
Note: An iPad may take longer to charge while syncing or in use. If the iPad is connected to a source that does not provide sufficient power to charge the device, a “Not Charging” message appears next to the battery icon in the status bar.

Not Charging 

Force an App to Close

The following procedure forces an app that is nonresponsive or not performing as expected to close. Forcing an app to close is a recommended first troubleshooting step.

iPhone X or later or iPad running software version 12 or 13: <ol style="list-style-type: none">1. Swipe up from the bottom of the screen to see the App Switcher.2. Swipe up on the app.	iPhone X or iPad running iOS 11: <ol style="list-style-type: none">1. Swipe up from the bottom of the screen to see the App Switcher.2. Tap and hold the app until the minus button appears.3. Tap the minus button or swipe up on the app.
<p style="text-align: center;">iOS 12</p> 	<p style="text-align: center;">iOS 11</p> 
iPhone with Home button or iPad running iOS 7 or later: <ol style="list-style-type: none">1. Double-click the Home button to see the App Switcher.2. Swipe up on the app.	
<p style="text-align: center;">iOS 9 and 10</p>	<p style="text-align: center;">iOS 7 and 8</p>



Restart

Restarting saves user data, closes all open applications, turns off all hardware components, and then restarts the device.

A restart can quickly resolve a wide range of issues, including the following issues:

- Apps unexpectedly quit.
- Battery life is shorter than expected.
- Hardware is not performing as expected.
- Interface or apps are slow to respond.
- A computer does not recognize or sync with the device.

Procedure

For devices running iOS 11 and later:

1. Choose Settings > General > Shut Down.
2. Drag your finger across the slider to turn off the device.
3. Turn on the device by pressing and holding the Sleep/Wake button or side button until the Apple logo appears.

iPhone 8 and earlier, iPad, and iPod touch:

1. Press and hold the Sleep/Wake button or side button until a slider appears.
2. Drag your finger across the slider to turn off the device.
3. Turn on the device by pressing and holding the Sleep/Wake button or side button until the Apple logo appears.

iPhone X and later, iPad Pro 11-inch, and iPad Pro 12.9-inch (3rd generation):

1. Press and hold the Volume Down button and the side button until a slider appears.
2. Drag your finger across the slider to turn off the device.
3. Turn on the device by pressing and holding the side button until the Apple logo appears.

Note: If the device is unresponsive and won't restart, [reset the device](#).

iOS Reset

If the device is unresponsive and will not restart, try to reset it.

Important: Reset the device only if it will not restart.

Key Points

- Resetting the device removes all power for a fraction of a second to turn off the device.
- Resetting the device does not close open files or save data before the device turns off.
- **Caution:** Resetting the device can potentially cause file or operating system damage, requiring a restore.

Procedure

iPhone 8 and later, iPad Pro 11-inch, and iPad Pro 12.9-inch (3rd generation):

1. Press the Volume Up button.
2. Press the Volume Down button.
3. Press and hold the Side or Top button for at least 10 seconds, until you see the Apple logo.

iPhone 7 and iPod touch (7th generation):

- Press and hold both the Volume Down button and the Side or Top button for at least 10 seconds, until you see the Apple logo.

iPhone 6s and earlier, iPad, and iPod touch (6th generation and earlier):

- Press and hold both the Sleep/Wake button and Home button for at least 10 seconds, until you see the Apple logo.

Erase All Content and Settings

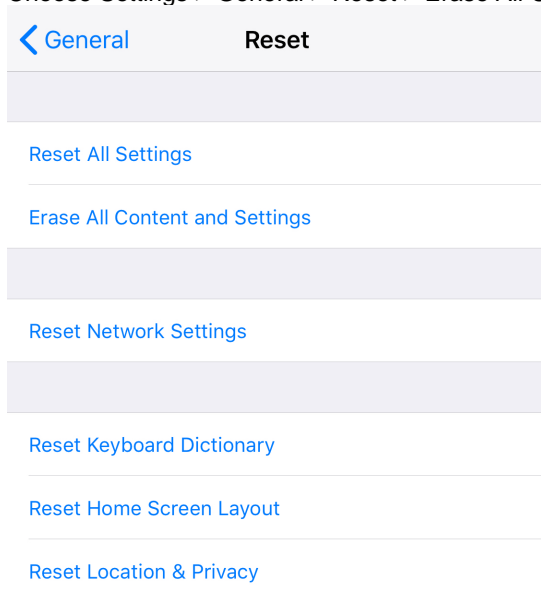
Erasing all content and settings is a quick way to restore the device to factory settings. Erase All Content and Settings can resolve software issues more quickly than a time-consuming restore, but it will not reinstall iOS like a restore does.



Caution: Erasing all content and settings will delete all user data and settings on the device.

Important: Before servicing a device, verify that the user has [disabled Activation Lock](#) on the device. **Procedure:**

1. Choose Settings > General > Reset > Erase All Content and Settings.



If erasing all content and settings does not resolve the issue, proceed with a [Restore](#).

Restore

A restore completely erases the device and installs the latest version of iOS.



Caution: Restoring the device will delete all user data and settings.

Important: Before servicing a device, ensure that the customer has disabled Find My iPhone in Settings.

Key Points:

- A restore erases all user content, settings, and iOS files, and then reinstalls only iOS.
- A restore is time-consuming, especially if you have to download the restore package.

Note: When restoring a device with iTunes on a customer's computer, copy or rename the backup folder before proceeding to avoid erasing previous iTunes backups.

Procedure:

1. Connect the device to a computer running the latest version of iTunes.
2. Open iTunes, select the device, click Summary, then click the Restore iPhone button.
3. When the restore is complete, set up the device as new and test it before restoring a backup or syncing content.



Recovery Mode Restore

If a computer cannot detect the device or a specific restore error appears, check the cable connections. If the issue persists, put the device in recovery mode.



Caution: If the device is put in recovery mode and then restored, all user data and settings will be erased.

If you cannot restore the device, even when it is in recovery mode, discuss service and replacement options with the user.

Key Points

Recovery mode loads only the firmware drivers necessary for a computer to recognize the device. If iTunes displays an error code alert, then refer to the following articles:

Note: In certain situations, a device will automatically enter recovery mode after an update or restore. If the device is connected to a computer, updating the software may resolve an issue without erasing user data and settings. If updating the software does not work, it may be necessary to restore the device, which will erase all user data and settings.

Procedure

Perform the following steps to put the device in recovery mode. If the device is already in recovery mode, connect the device to a computer and start at step 3.

1. Connect the device to a computer and open iTunes.

Note: You can connect the device to a power adapter instead of a computer and continue with step 2. If you are able to complete step 2 and put the device in recovery mode, disconnect it from the power adapter and connect it to a computer. Then continue with step 3.

2. While the device is connected, force restart it with these steps:

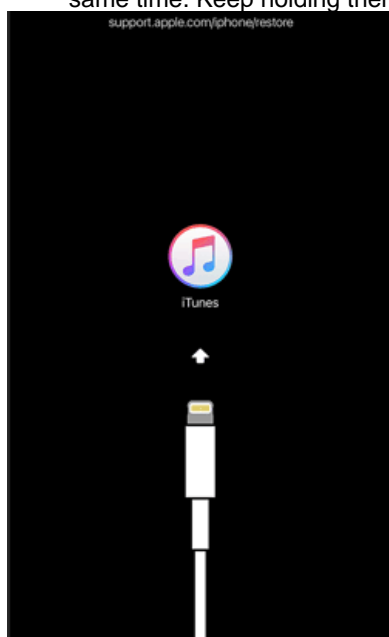
iPad Pro 11-inch or iPad Pro 12.9-inch (3rd generation): Press and quickly release the Volume Up button. Press and quickly release the Volume Down button. Press and hold the Top button until the device begins to restart. Continue holding the Top button until the Connect to iTunes screen appears.

iPhone 8 and later: Press and quickly release the Volume Up button. Press and quickly release the Volume Down button. Then, press and hold the Side button until the Connect to iTunes screen appears.

iPhone 7 or iPhone 7 Plus: Press and hold the Side and Volume Down buttons at the same time. Keep holding them until the Connect to iTunes screen appears.

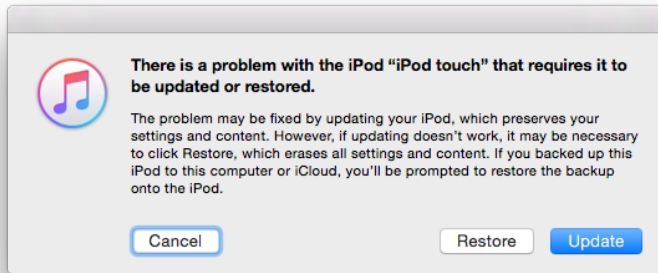
iPod touch (7th generation) only: Press and hold the Top and Volume Down buttons at the same time. Keep holding them until the Connect to iTunes screen appears.

iPhone 6s and earlier, iPad, or iPod touch: Press and hold both the Home and the Top (or Side) buttons at the same time. Keep holding them until the Connect to iTunes screen appears.

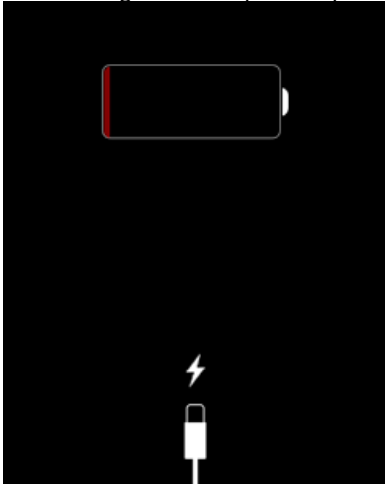


3. Use iTunes to update or restore the device. Updating the device may preserve the user data and settings. Restoring

the device will erase all user data and settings.



If the charging screen appears, connect the device to a power adapter for at least 10-15 minutes to ensure the battery has some charge. Then repeat steps 1 through 3.



If the Connect to iTunes screen does not appear, repeat steps 1 through 3.

If you decide not to do a restore, you may be able to exit recovery mode by resetting the device.

If you are unable to restore the device, see the appropriate service guide for additional troubleshooting.

Take-Apart General Information

Before You Begin

- Refer to the Visual/Mechanical Inspection (VMI) Guide to determine whether the device has accidental damage. Check for an activated liquid contact indicator (LCI) before opening the device. Remove the SIM tray to view the externally visible LCI.
- Remove all cases and screen protectors.
- Verify the user-reported symptoms and identify the necessary repair parts.
- Drag the slide to power off slider to ensure that the device is turned off.

Electrostatic Discharge (ESD) Precautions

[Always take proper ESD precautions when opening iPhone](#) (OP100). Work on a properly grounded ESD-safe mat and wear a properly connected ESD-safe wrist strap.

Required Tools

Servicing iPhone 6 and later (excluding iPhone SE) requires the following tools:

- ESD-safe brush (922-9918)
- ESD-safe tweezers
- ESD-safe wrist strap
- ESD-safe workstation
- 4.7-inch repair tray (923-02836)*
- 5.5-inch repair tray (923-02837)*
- 5.8-inch repair tray (923-02661)*
- 6.1-inch repair tray (923-02663)*
- 6.5-inch repair tray (923-02662)*
- 5.8-inch repair tray for iPhone 11 Pro (923-03570)*
- 6.1-inch repair tray for iPhone 11 (923-03571)*
- 6.5-inch repair tray for iPhone 11 Pro Max (923-03572)*
- iPhone battery fixture (923-02657)
- Torque driver (blue), 0.65 kgf cm (923-0448)
- Torque driver (gray), 0.55 kgf cm (923-00738)
- Torque driver (green), 0.45 kgf cm (923-00105)
- Torque driver kit (923-0248) includes:
 - Torque driver (black), 0.35 kgf cm (923-0245)
 - Torx security bit (923-0247)
 - JCIS bit for crosshead screws (923-0246)
- Microstix bit (923-01290)
- Superscrew bit (923-01289)
- 2.1 mm Superscrew bit (923-02066)
- Microfiber polishing cloth
- Motorola DS4208 scanner (923-0445)
- Black stick (922-5065)
- Packing tape
- SIM removal tool (922-8417) or paper clip (size #1)
- Universal display removal fixture (923-01385)

Servicing iPhone 6s and later requires the following additional tools:

- Universal display removal adapter (923-00652)
- Display press (661-08916)
- Adhesive cutter (923-01915)
- Display adhesive cutter wheel (923-01916)

Servicing iPhone XR requires a display adhesive cutter (923-01092).

*The following repair trays are marked with a symbol in the upper-right corner:

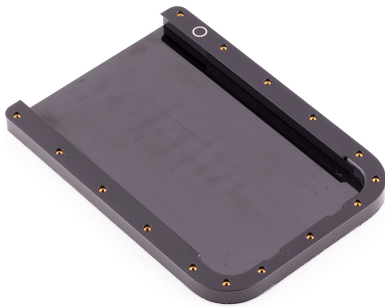
- 4.7-inch repair tray: hexagon
- 5.5-inch repair tray: diamond

- 5.8-inch repair tray: plus sign
- 6.1-inch repair tray: circle
- 6.5-inch repair tray: infinity symbol
- 5.8-inch repair tray for iPhone 11 Pro: equals sign
- 6.1-inch repair tray for iPhone 11: circle
- 6.5-inch repair tray for iPhone 11 Pro Max: sun



Use the support frame when the back glass is broken on iPhone 8 or later. **Caution:** Apply the back protective cover before placing the device in the support frame.

- 4.7-inch support frame (923-01924): no symbol
- 5.5-inch support frame (923-01923): no symbol
- 5.8-inch support frame (923-01922): no symbol
- 6.1-inch support frame (923-02666): circle
- 6.5-inch support frame (923-02665): infinity symbol
- 5.8-inch support frame for iPhone 11 Pro (923-03573): no symbol
- 6.1-inch support frame for iPhone 11 (923-03575): circle
- 6.5-inch support frame for iPhone 11 Pro Max (923-03574): no symbol



Torque drivers limit the amount of force applied to a screw when you tighten it (by turning it clockwise). They don't limit the amount of force applied to a screw when you remove it (by turning it counterclockwise). You must tighten all screws to a specific torque value during a repair. Use the torque driver called for in the take-apart instructions to set each screw to the correct torque value. The correct driver is also noted in the screw diagram section of the Internal View, Parts List, Screw Diagram for each model.

- Torque driver (gray), 0.55 kgf cm (923-00738)
- Torque driver (black), 0.35 kgf cm (923-0245)
- Torque driver (green), 0.45 kgf cm (923-00105)
- Torque driver (blue), 0.65 kgf cm (923-0448)



iPad, iPhone, iPod, Apple Watch Device Safety

Battery Handling

iPad, iPhone, iPod, and Apple Watch include a lithium-polymer rechargeable battery. When you use and repair this battery under reasonable conditions and according to instructions, it should not present a health hazard. The contents of the battery are encapsulated. But if the contents are released or damaged, they may present potential health and safety hazards. Avoid exposure to heat and open flame. Don't puncture, deform, crush, or incinerate a battery, as a thermal runaway reaction and excessive heating may result.



Warning: Non-Apple batteries require a specific [battery discharge procedure](#).

Warning: If the battery is dented, punctured, swollen, or otherwise damaged, then stop the repair. Don't remove the battery from the device. Replace the whole unit.

Warning: Don't reuse or reinstall a loose battery or a battery that has been removed. Install a new battery. If a new battery is unavailable, replace the whole unit.

Thermal Runaway Events with Lithium-Ion (LiO) / Lithium-Polymer Batteries

The following statements are intended as guidance only. Only properly trained and equipped personnel should respond to a thermal runaway event.

The most effective way to prevent a lithium-ion/lithium-polymer battery thermal event is to discharge the battery before opening the device or working on or near the battery. (A battery with a charge of less than 25 percent can't produce a thermal event.)

If a battery begins to smoke, spark, hiss, or pop, it's most likely undergoing a thermal runaway. The most effective way to stop the reaction is to immediately smother the battery with plenty of clean, dry sand. This will smother the reaction and limit the amount of smoke produced.

Don't use water or an ABC or CO2 fire extinguisher on a thermal runaway battery, as they will not effectively stop the reaction and will create a bigger mess to clean up.

Cleanup

1. Sweep up used sand, remove any debris, and return the remaining clean sand to the quick-pour container for future use. Add more sand to the container from supplementary sand containers as needed.
2. Wipe the workstation with water. Use an ESD-mat cleaning solution on the affected area.
3. Return batteries and debris removed from the sand according to your location's recycling and scrap procedures.

Personal Protection

Respiratory Protection	Not necessary under normal conditions.
Eye and Face Protection	Always wear safety glasses with side shields when performing repair work involving batteries, broken glass, or any task with potential eye hazards.
Gloves	Not necessary under normal conditions. Use disposable latex or nitrile gloves when handling an open or leaking battery.

First Aid

Inhalation	The contents of an open battery or the smoke from a thermal runaway event may cause respiratory irritation. Leave the area if necessary for comfort. Get fresh air and medical attention if you're feeling sick.
Ingestion	Ingesting a lithium-ion battery is highly unlikely as the contents are mostly solid, and any liquid (ester-based electrolyte) that might drip out of a damaged battery is limited to a few drops. But don't touch your fingers to your mouth while handling a damaged battery to avoid ingesting contents. Don't induce vomiting. Wash out your mouth with water. Get medical attention following exposure or if you're feeling sick.
Skin Contact	The contents of an open battery may cause skin irritation. Flush contaminated skin with plenty of water. Remove any contaminated clothing. Continue to rinse your skin for at least 15 minutes. Get medical attention. Wash your clothes before reuse.
Eye Contact	The contents of an open battery may irritate your eyes. Immediately flush your eyes with plenty of water, occasionally lifting the upper and lower eyelids. Remove any contact lenses. Continue to rinse your eyes for at least 15 minutes. Get medical attention if irritation persists.

Disclaimer: The above information is provided for your information only. The information and recommendations set forth above are made in good faith and are believed to be accurate as of the date of preparation. Apple Inc. makes no warranty, either expressed or implied, with respect to this information and disclaims all liability from reliance on it.

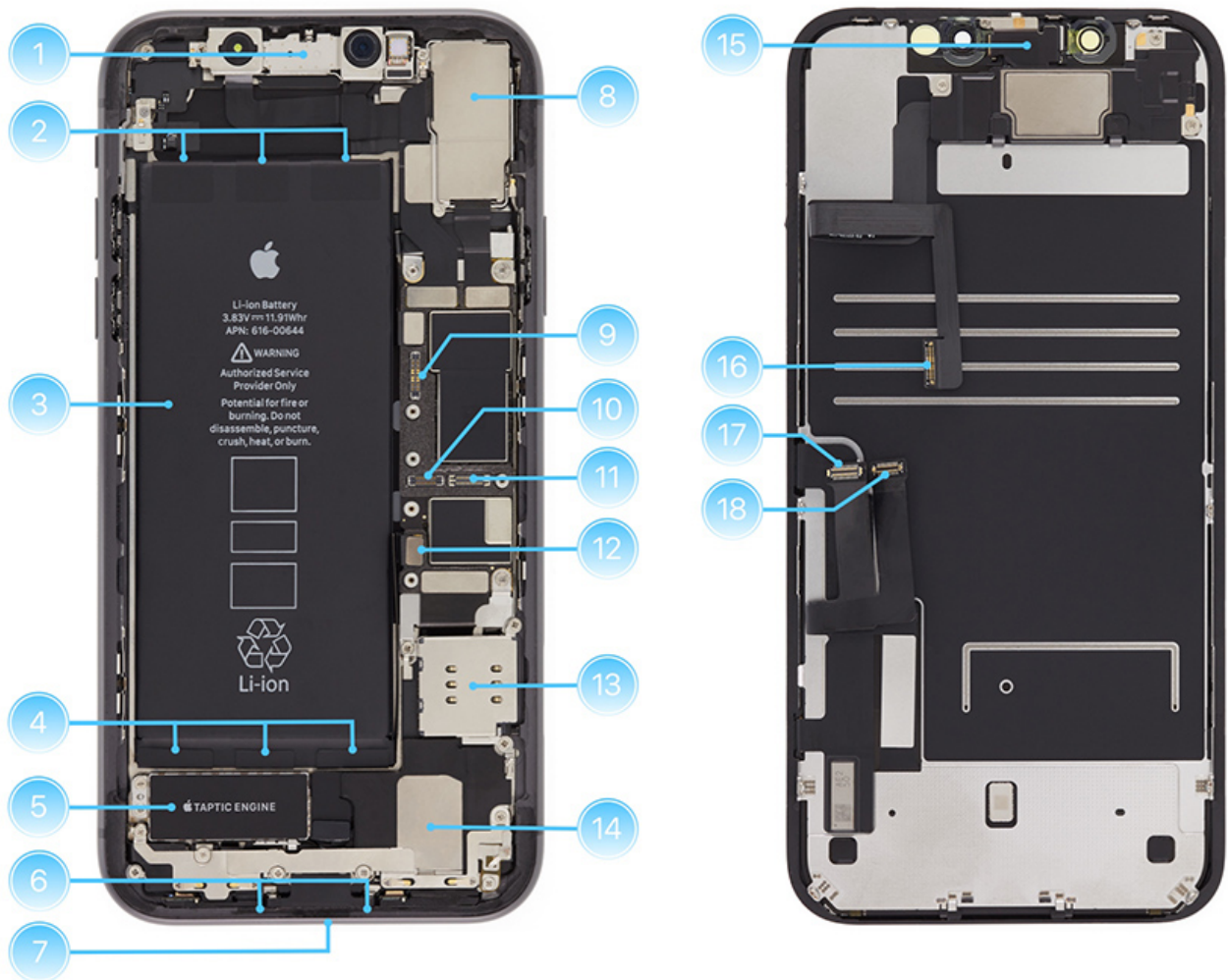
Handling Broken Glass

iPad, iPod, and Apple Watch displays, as well as iPhone 4, 4s, 8, 8 Plus, X, XS, XS Max, XR, 11, 11 Pro, 11 Pro Max back covers are made of glass. The glass could break if the device is dropped on a hard surface, receives a substantial impact, or is crushed, bent, or deformed. If the glass chips or cracks, don't attempt to remove it. Perform the following steps:

- If the display glass is broken, put on safety glasses and cut-resistant gloves.
- Use a vacuum to remove any glass shards from the work surface and display.
- Attach a protective display cover or packing tape to the display before removal to prevent injury or scattering of glass.
- Don't let the display cover or tape go over the edge of the display.

iPhone 11 Internal View, Parts List, Screw Diagram

Internal View of iPhone 11



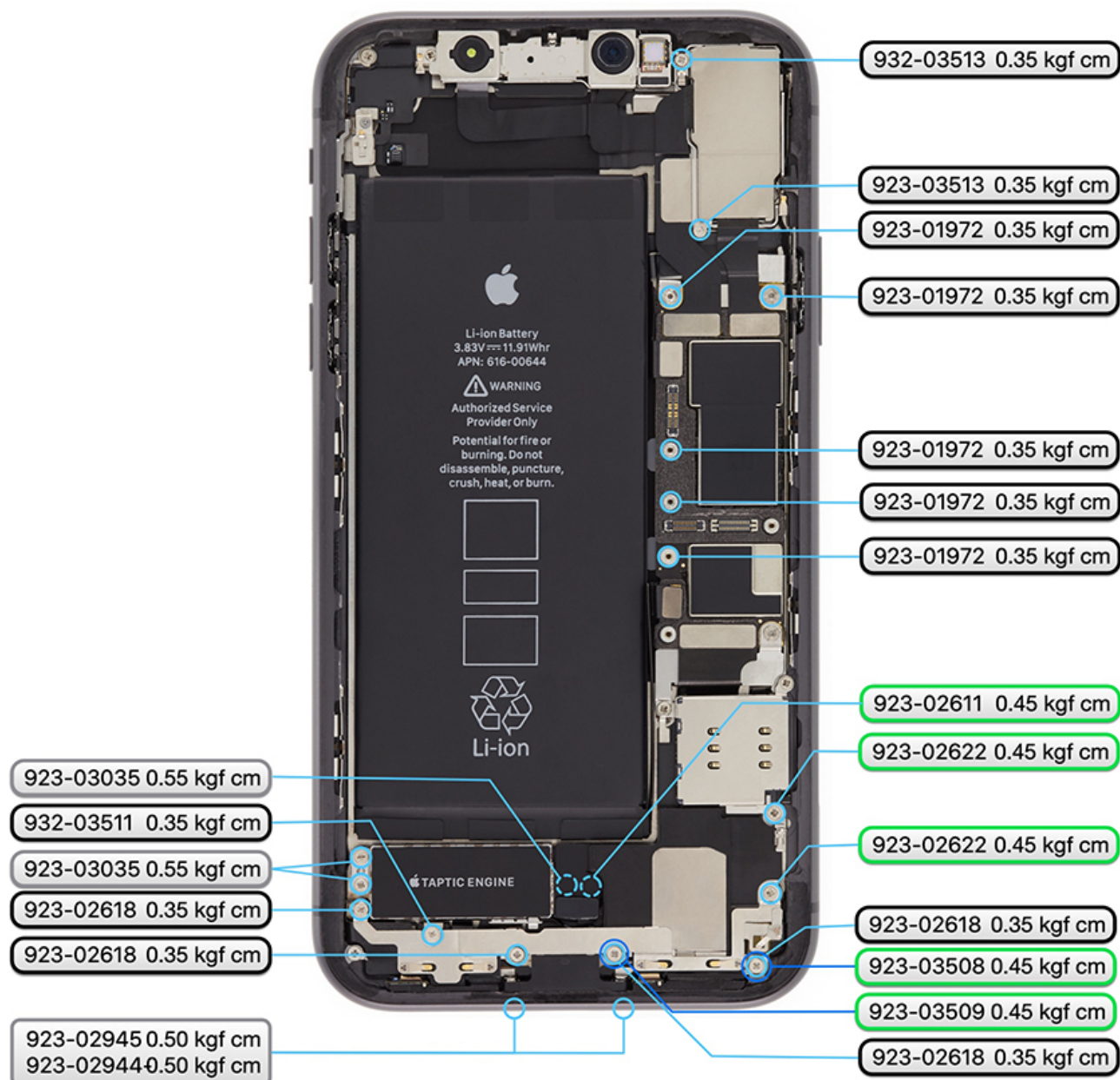
1. TrueDepth camera assembly
2. Battery adhesive tabs
3. Battery
4. Battery adhesive tabs
5. Taptic Engine
6. Bottom microphones
7. Lightning connector
8. Camera
9. Receiver/ambient light sensor/proximity connector
10. Display connector
11. Multi-Touch connector
12. Battery connector
13. SIM Cage
14. Speaker
15. Receiver
16. Receiver/ambient light sensor/proximity flex
17. Multi-Touch flex
18. Display flex

Parts List

Description	Part Number	Kit Contents (order screws separately)	Screws
Battery Kit	661-13574	1 battery 1 battery adhesive pack	
Camera	661-13575	1 camera	
Camera Cowling	923-03514	10 cowlings	923-03513
Display	661-14098	1 display 1 display screw kit	
Display Cowling	923-03516	10 cowlings	923-01972
Display Adhesive	923-03566	30 display adhesive sheets Important: Adhesive expires after one year and should be discarded. Each box of adhesive has a (9D) number on the top right corner of the part label. The first two numbers indicate the year and the second two numbers indicate the week. The expiration date is one year from the date in the (9D) number.	
Foam Sticker	923-03008	60 foam stickers	
Grounding Spring	923-03709	10 grounding springs	923-02622
Lower Cowling	923-03510	10 cowlings	923-02622 923-02618 923-03511
Security Screws		100 screws	923-02944 (for black) 923-02945 (for all other colors)
SIM Tray	923-03634 Single, purple 923-03635 Single, green 923-03633 Single, yellow 923-03632 Single, red 923-03631 Single, white 923-03630 Single, black 923-03640 Dual, purple 923-03641 Dual, green 923-03639 Dual, yellow 923-03638 Dual, red 923-03637 Dual, white 923-03636 Dual, black	1 SIM tray	
Speaker	923-03506	1 speaker	
Taptic Engine	923-03512	1 Taptic Engine	
Taptic Engine Flex Cowling	923-03507	10 Taptic Engine flex cowling	923-03035

Screw Diagram

Use the black torque driver (0.35 kgfcm) for screws marked with a black outline.
Use the green torque driver (0.45 kgfcm) for screws marked with a green outline.
Use the gray torque driver (0.55 kgfcm) for screws marked with a gray outline.



Location of Grounding Springs



SIM Tray

First Steps

- Turn off the device.

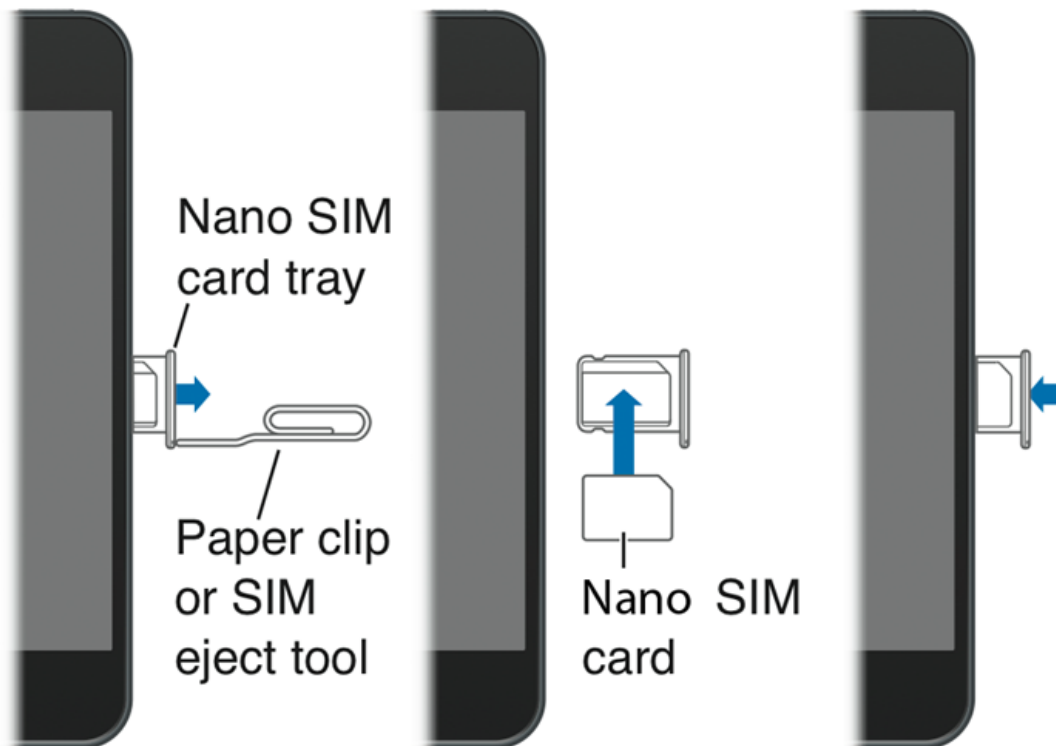


Tools

- SIM removal tool (922-8417) or paper clip (size #1)

Steps For Removal

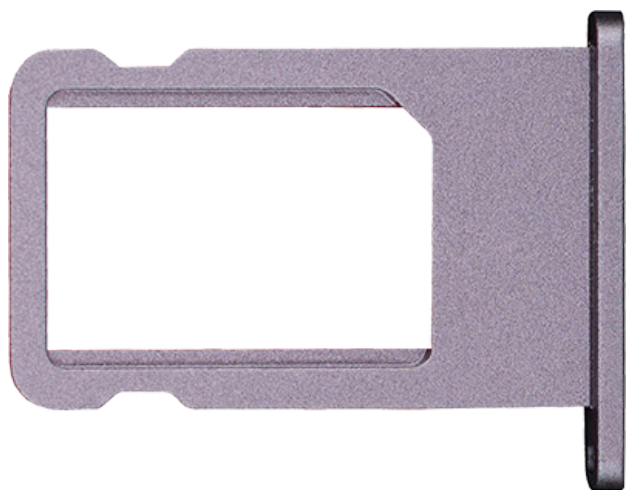
1. Insert the end of the SIM removal tool (922-8417) or paper clip (size #1) into the hole on the SIM tray.
2. Firmly push the tool straight in to eject the tray.



Steps For Reassembly

Note the orientation of the SIM tray and card before inserting it into the device.

Caution: Do not force the SIM tray into position. Forcing the SIM tray into position may damage the inside of the device.



iPhone 11 Open Device

First Steps

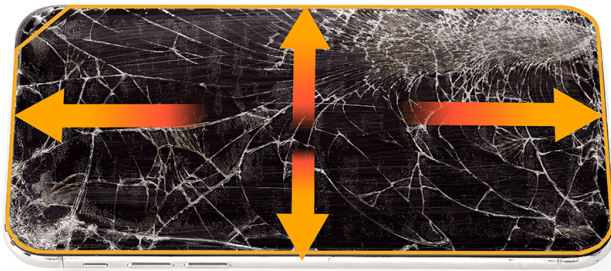
- Only Apple-certified technicians should perform this procedure.
- . Remove all cases and screen protectors.
- Follow electrostatic discharge (ESD) precautions.
- Turn off the device.



Warning: If the enclosure is separated due to a swollen battery, stop the repair. Do not remove the battery from the device. Replace the whole unit.

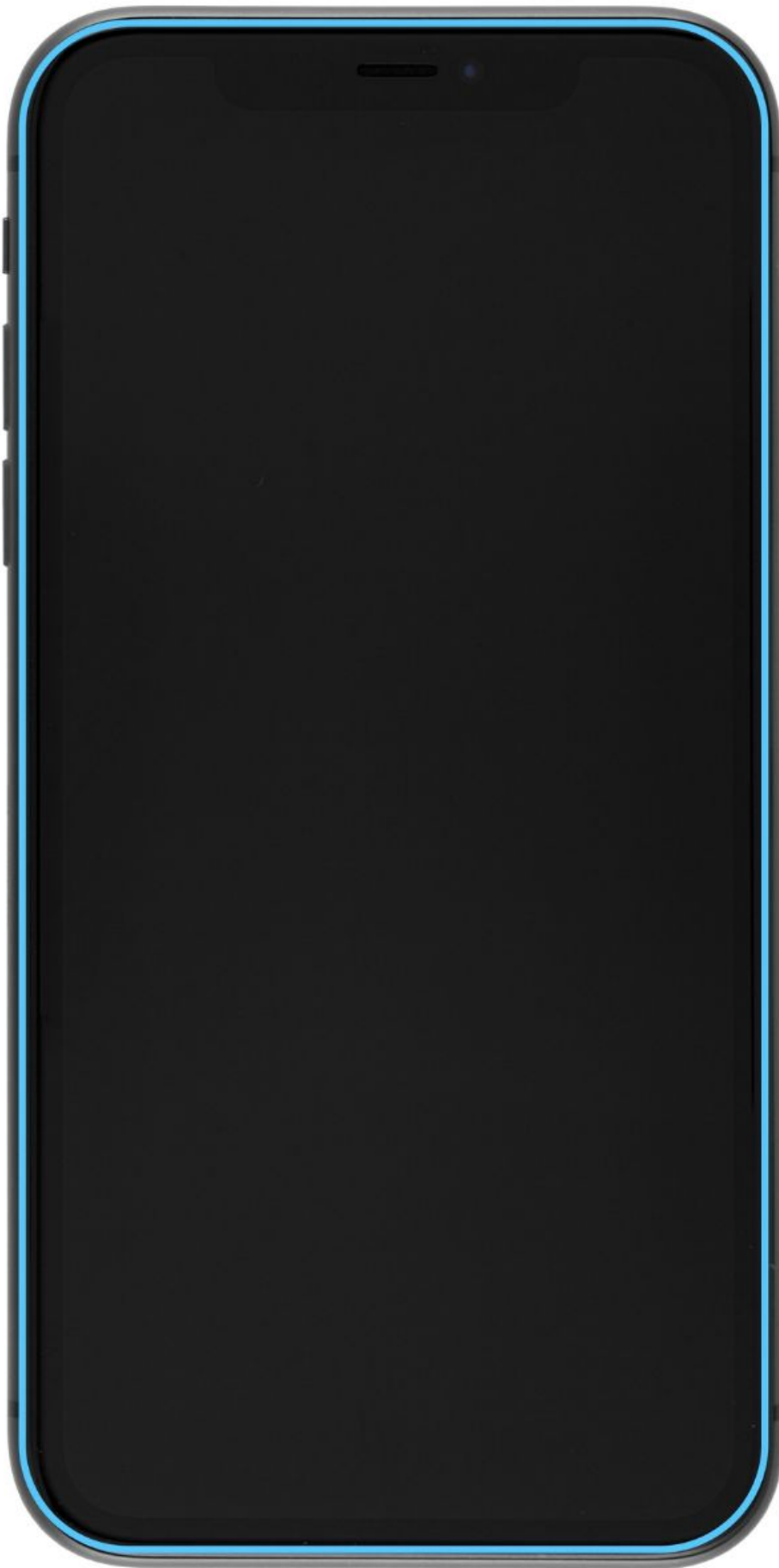
Warning: If the display glass is broken, put on safety glasses and material handling gloves. Use a vacuum cleaner to remove any glass shards from the workspace and display. Affix a display protective cover or packing tape to the display before removal to prevent injury or scattering of glass. Do not install the display cover or tape over the edge of the display.

When installing a 6.1-inch Display Protective Cover (923-02670), firmly press the cover onto the broken display to remove air bubbles and work the adhesive into the cracks in the glass. The cover should be left to settle into place for up to 12 minutes for more damaged displays before attempting to remove the display. The longer the display protective cover is left on the display, the stronger the bond between the cover and the broken glass.



If the back glass is broken, adhere a 6.1-inch Back Protective Cover (923-03569) before attempting a repair. If the protective cover does not adhere to the iPhone or if there is no glass for the film to adhere to, do not attempt a repair. Devices with this type of damage require a whole unit replacement.

Then place the iPhone in the 6.1-inch support frame (923-03575) before attempting to open the device. If the device does not fit in to the support frame, do not attempt a repair. Devices with this type of damage require a whole unit replacement.



Tools

1. Black torque driver (923-0248)
2. Gray torque driver (923-00738)
3. Security bit (923-0247)
4. Microstix bit (923-01290)
5. Black stick (922-5065)

6. Universal Display Removal Fixture (923-01385)
7. Universal Display Removal Adapter (923-00652)
8. Adhesive Cutter (923-01092) and wheel (923-01916)
9. 6.1-inch Repair Tray (923-03572)
10. Display Press (661-08916)
11. Isopropyl alcohol (IPA) wipes



Steps For Removal

1. Use a torque driver and security bit to remove and discard two security screws, one from each side of the Lightning connector.

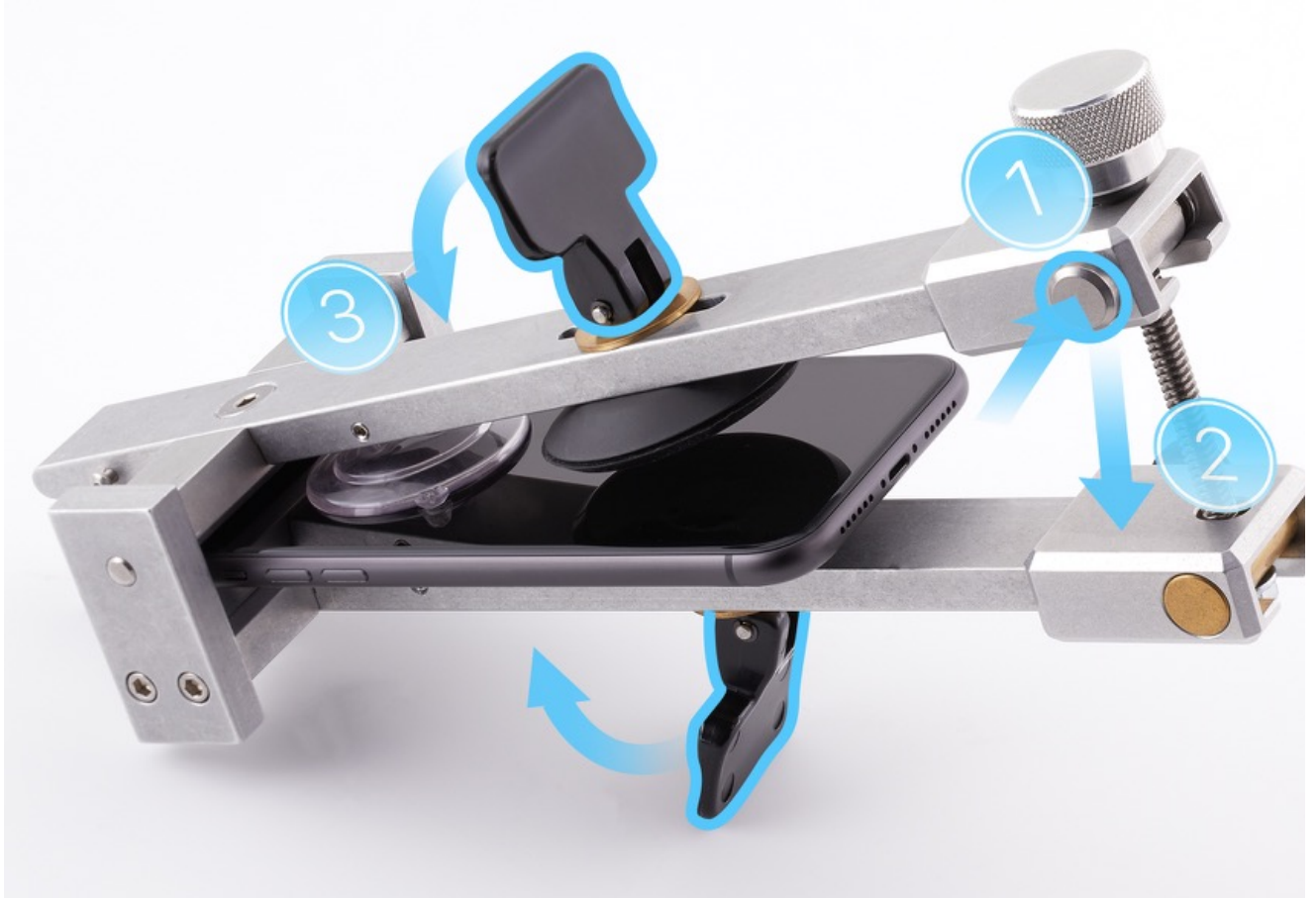


2. Secure the Universal Display Removal Adapter to the Universal Display Removal Fixture. Make sure that the handles of the fixture are fully inserted into the adapter and the thumb screws are tight.
3. Adjust the suction cup to the farthest point from the pivot and to the bottommost part of the display without overlapping the edge. Adjust the suction cup on the back of the device to align with the position of the one on the display. Press the iPhone down to secure the lower suction cups.

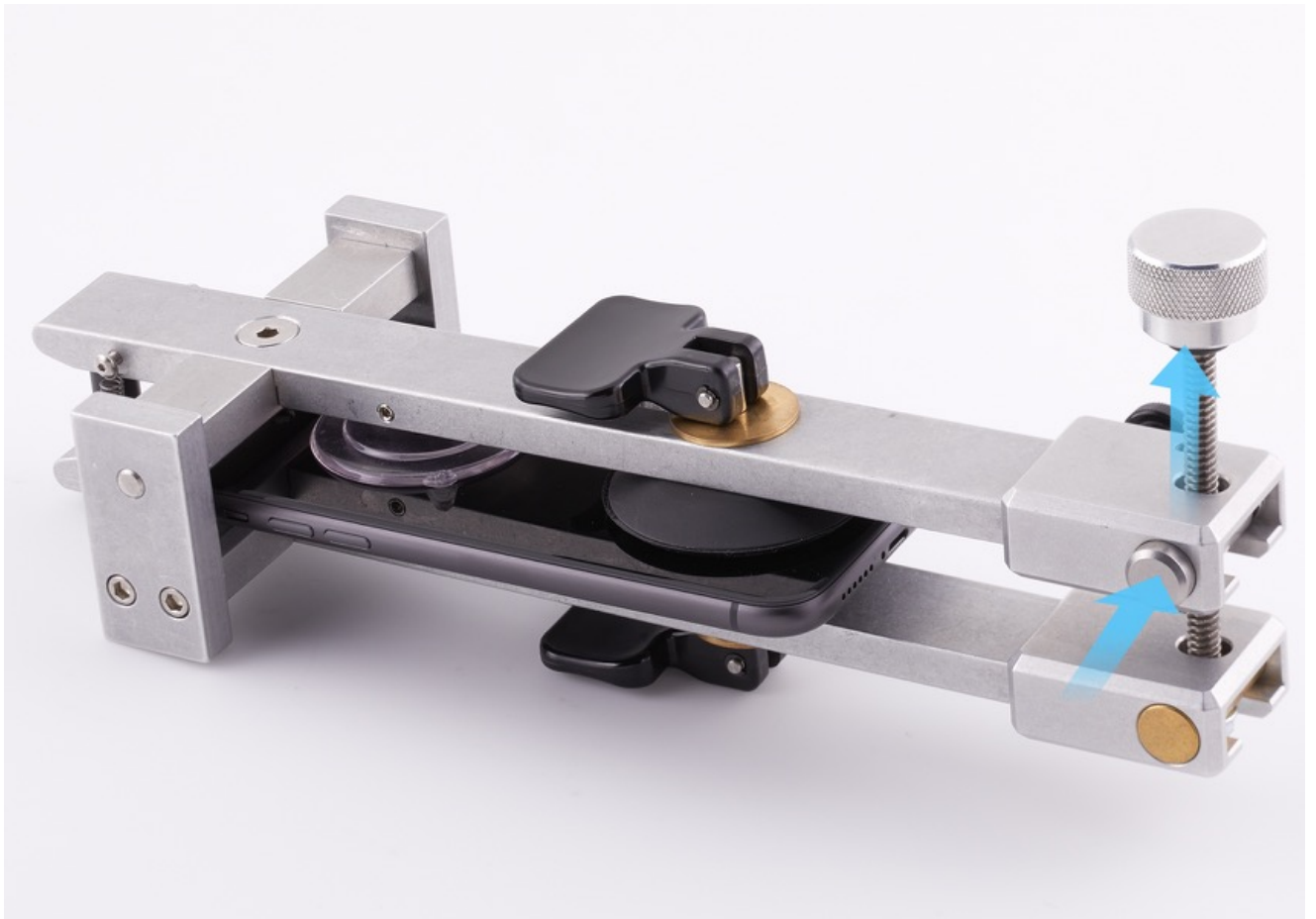
Caution: Use an updated Universal Display Removal Fixture and Display Removal Adapter. Other fixtures may damage the device.



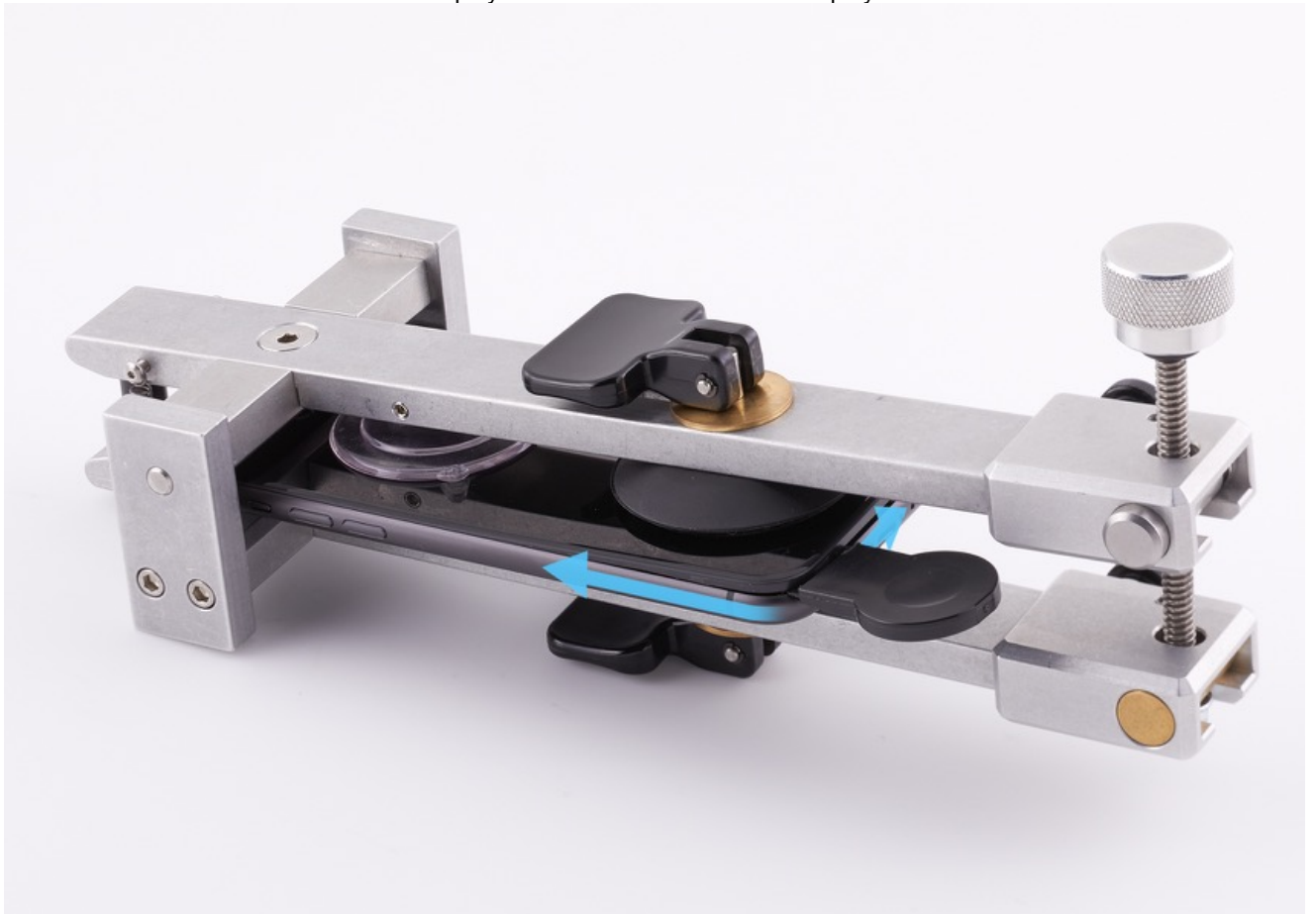
4. Press and hold the release button on the adapter, then press the lever down to secure the suction cups to the display glass.



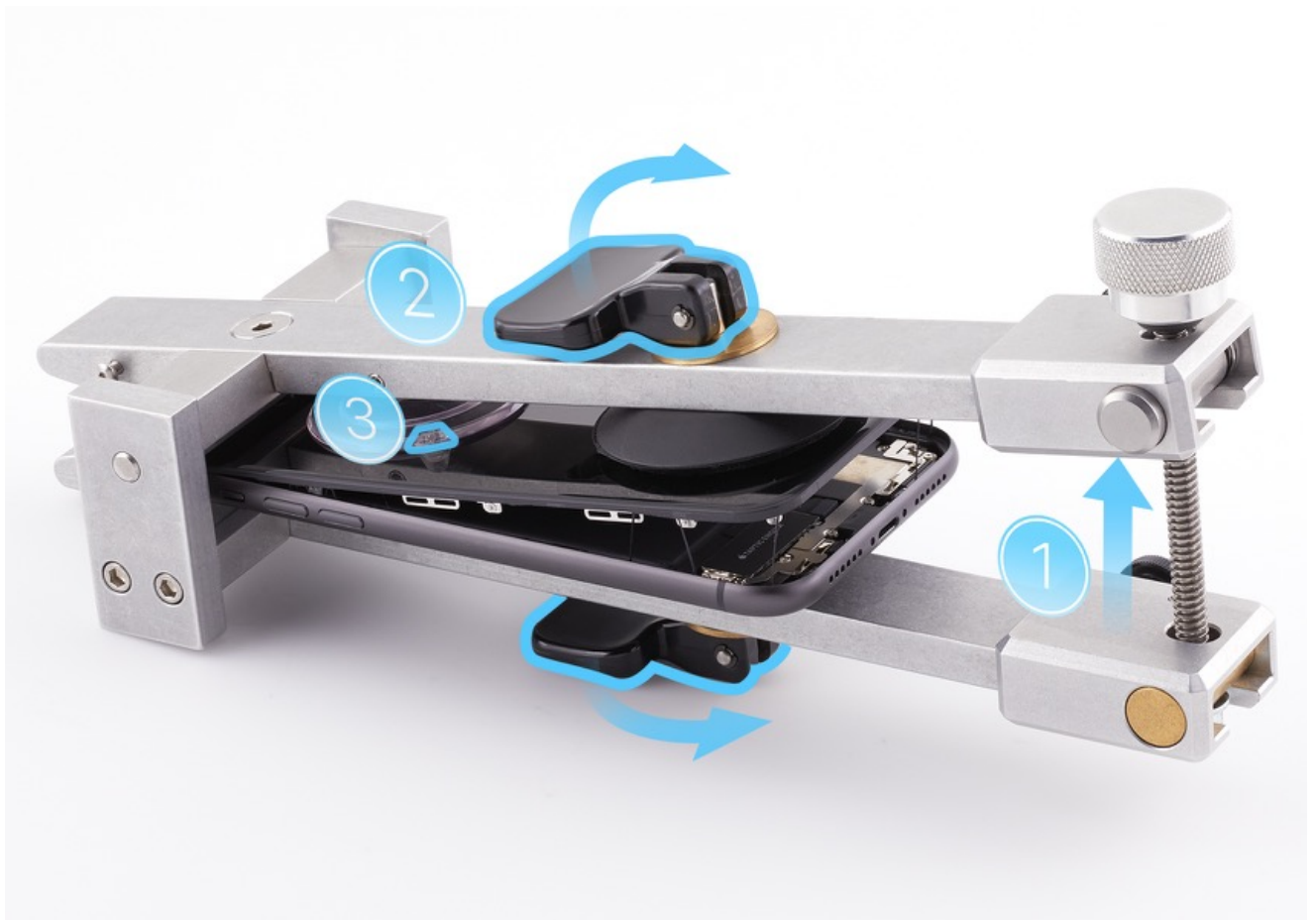
5. Press and hold the release button on the adapter, then slowly separate the metal bars until you feel resistance. Do not use excessive force.



6. Slowly turn the knob on the adapter until the display begins to separate from the enclosure.
7. Insert the Display Adhesive Cutter between the display and the enclosure until the edge of the cutter is inside the enclosure. Run the cutter between the display and the enclosure until the display is free.



8. Press the release button (1) then flip up the levers (2). Loosen the four suction cups to release the display and the enclosure from the fixture (3). **Note:** The bottom suction cup may reattach when attempting to remove the iPhone.



9. Place the iPhone into the repair tray and gently slide the display slightly toward the bottom of the device until the clips release, then tilt the bottom of the display up.
Caution: Do not pry the display.



10. Insert the adhesive cutter between the display and the enclosure near the top of the display. Run the cutter between the display and the enclosure until the display is free.
Note: Use the adhesive cutter at the angle shown in the image below.



Important: To avoid damaging the display flexes, do not tilt the display more than five degrees.



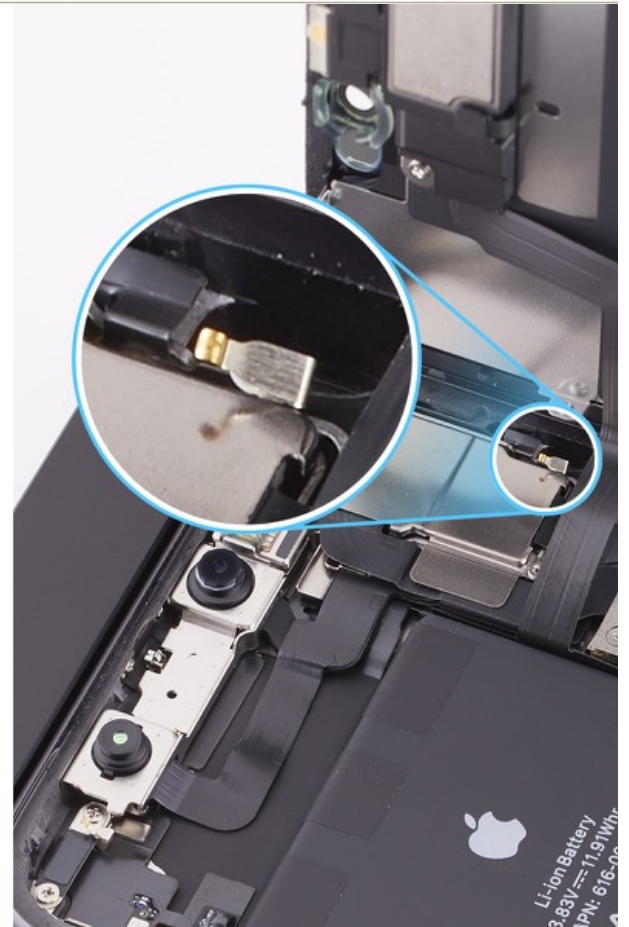
11. To avoid damaging the grounding clip on the edge of the enclosure, carefully lift the display straight up until all display clips are visible. If grounding clip is bent, restore to original condition with a black stick.



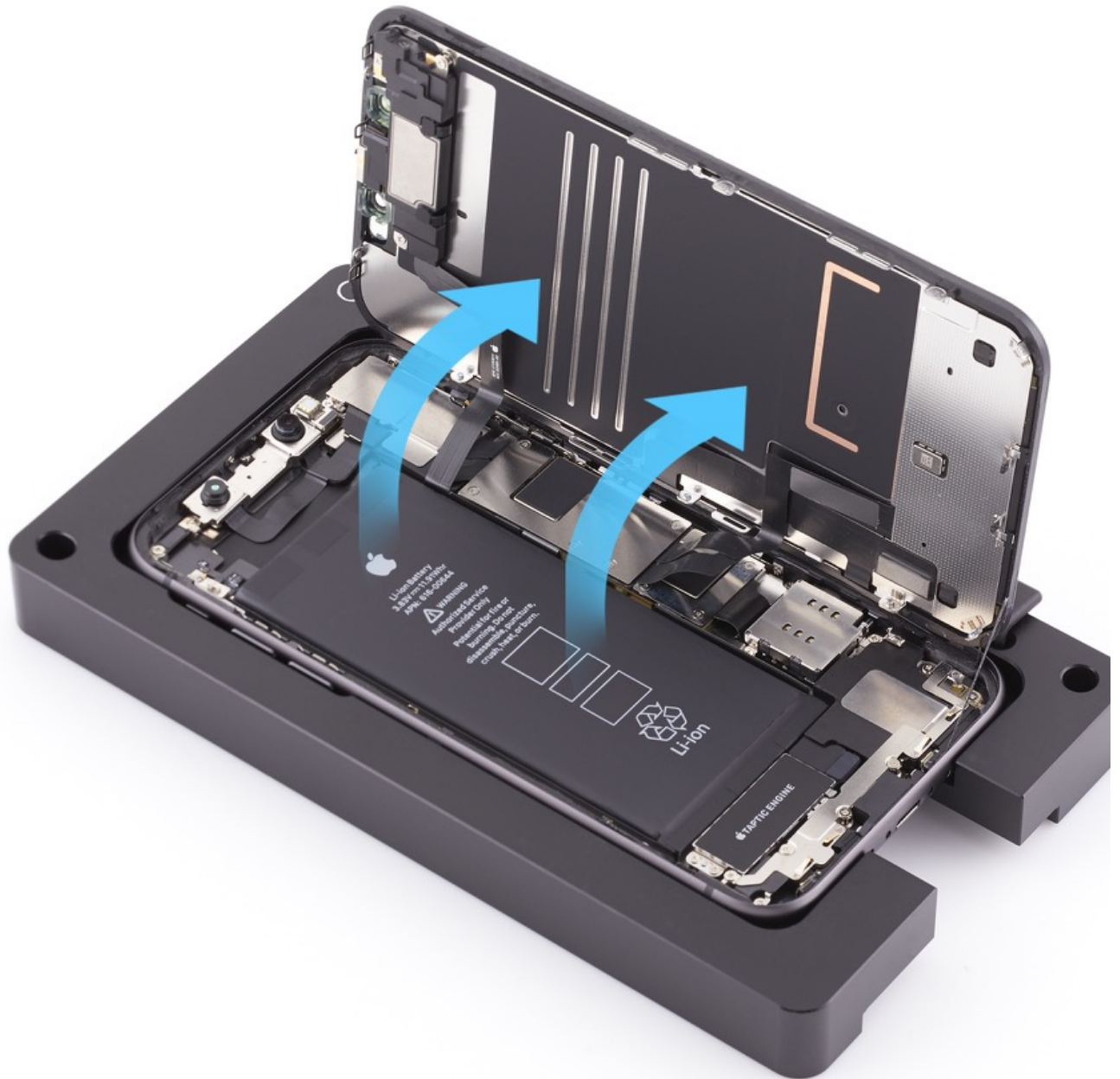
Straight Grounding Spring



Bent Grounding Spring



12. Carefully tilt the display to the right and position the display on the suction cups, leaving a gap between the enclosure and the display. Gently press along on the receiver and bottom edge of the display to secure the display to the suction cups.



Important: Do not press the back of the display to secure the display to the suction cup. Pressing the back of the display may affect image quality.

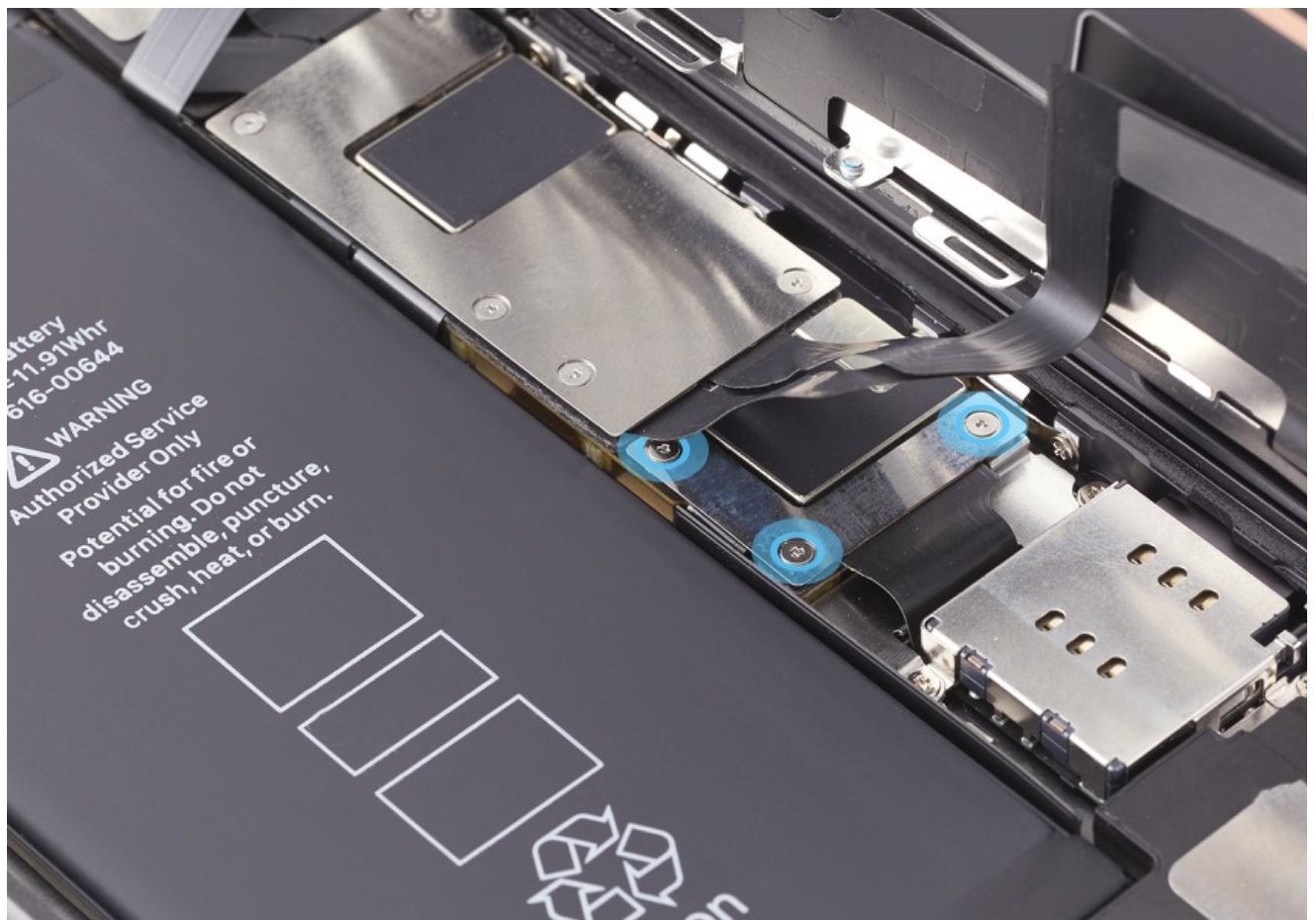


Caution: Make sure that the display clips are released before tilting the display to avoid damage to the enclosure or display. Do not damage the display flexes while lifting the display.

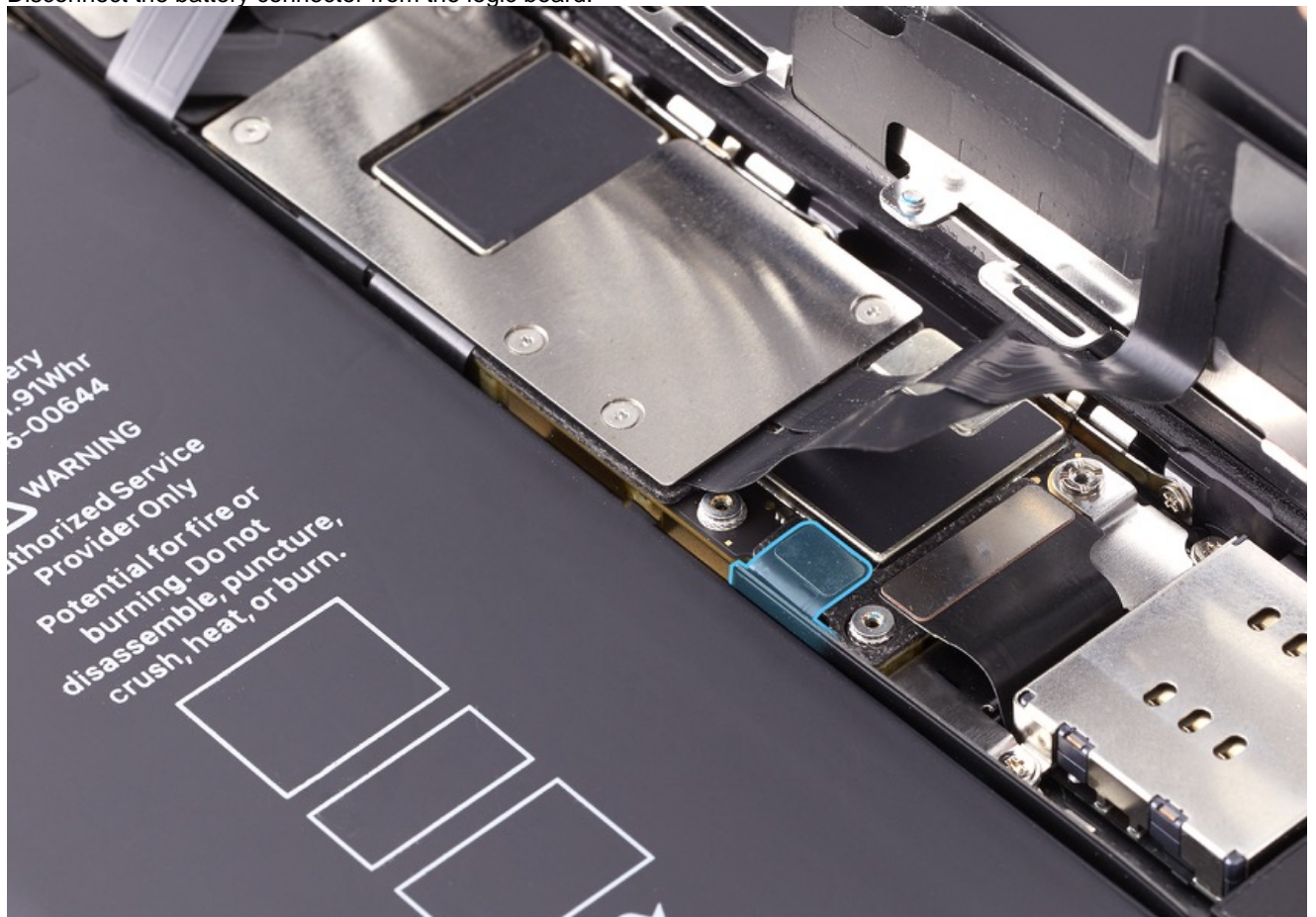
Warning: If the battery is dented, punctured, swollen, or otherwise damaged, then stop the repair. Do not remove the battery from the device. Reassemble the device and replace the whole unit.

13. Use the torque driver to remove and discard three Microstix screws from the battery cowling. Save the cowling for reuse.

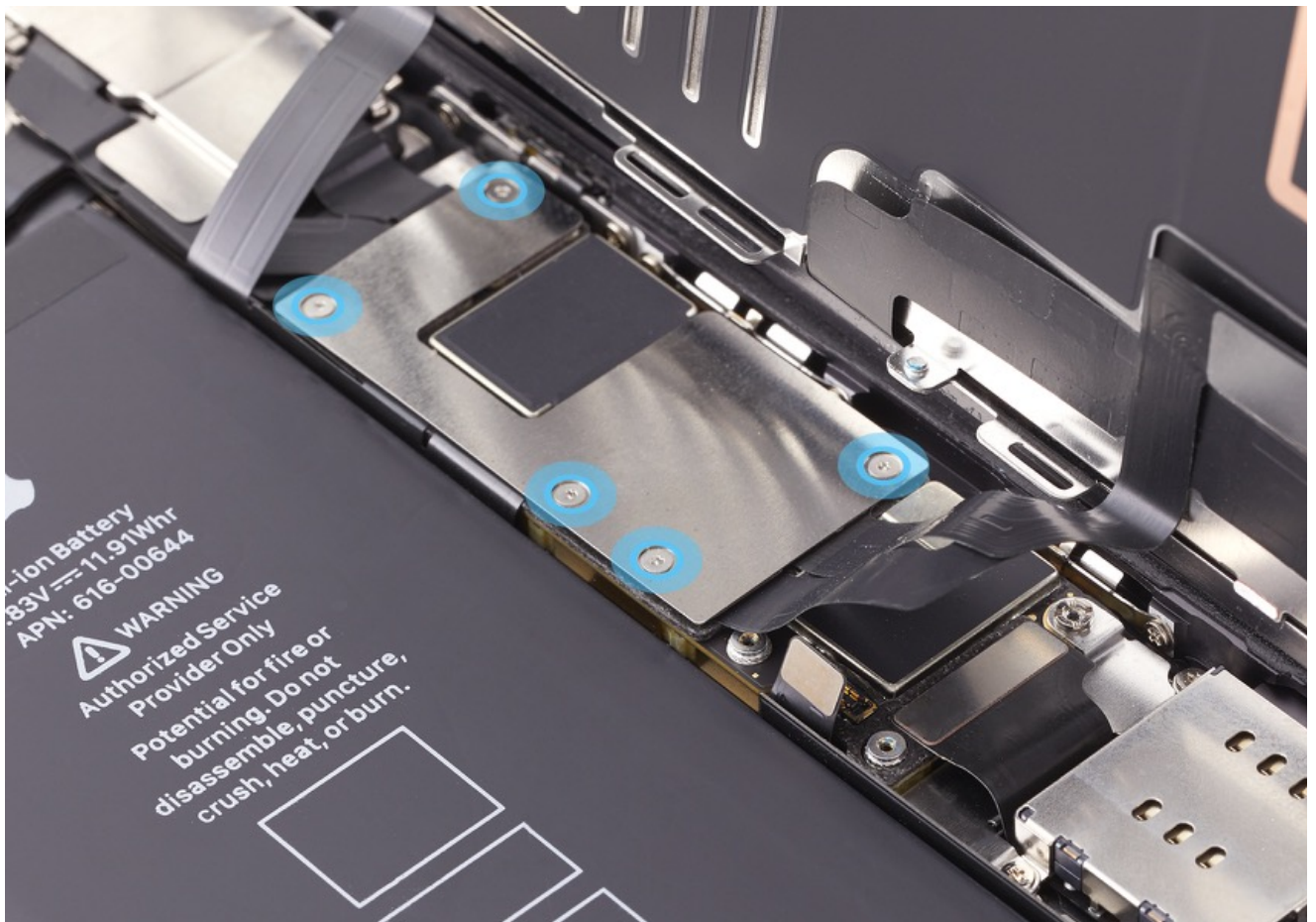
Important: Avoid touching the TrueDepth cameras and nearby components.



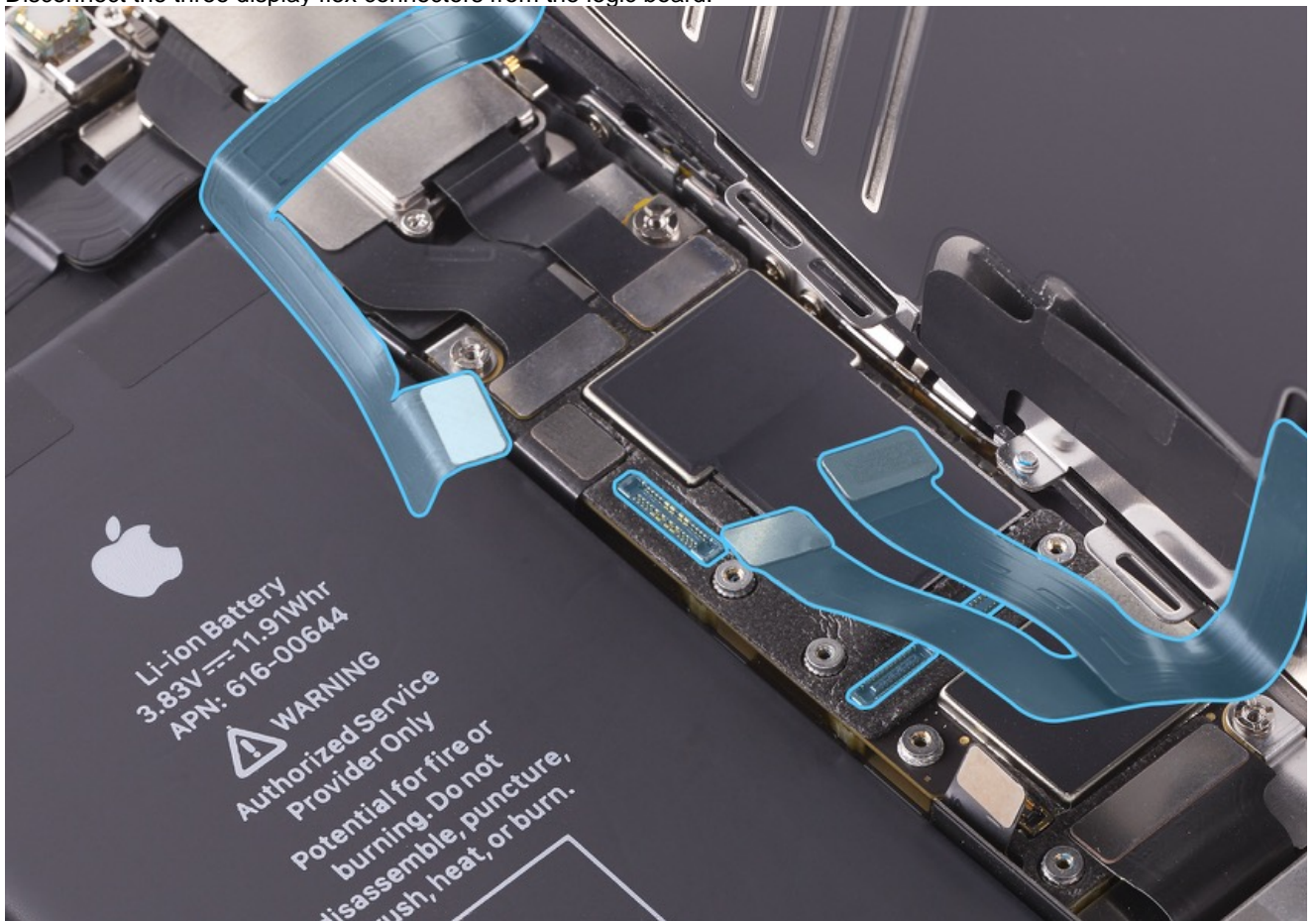
14. Disconnect the battery connector from the logic board.



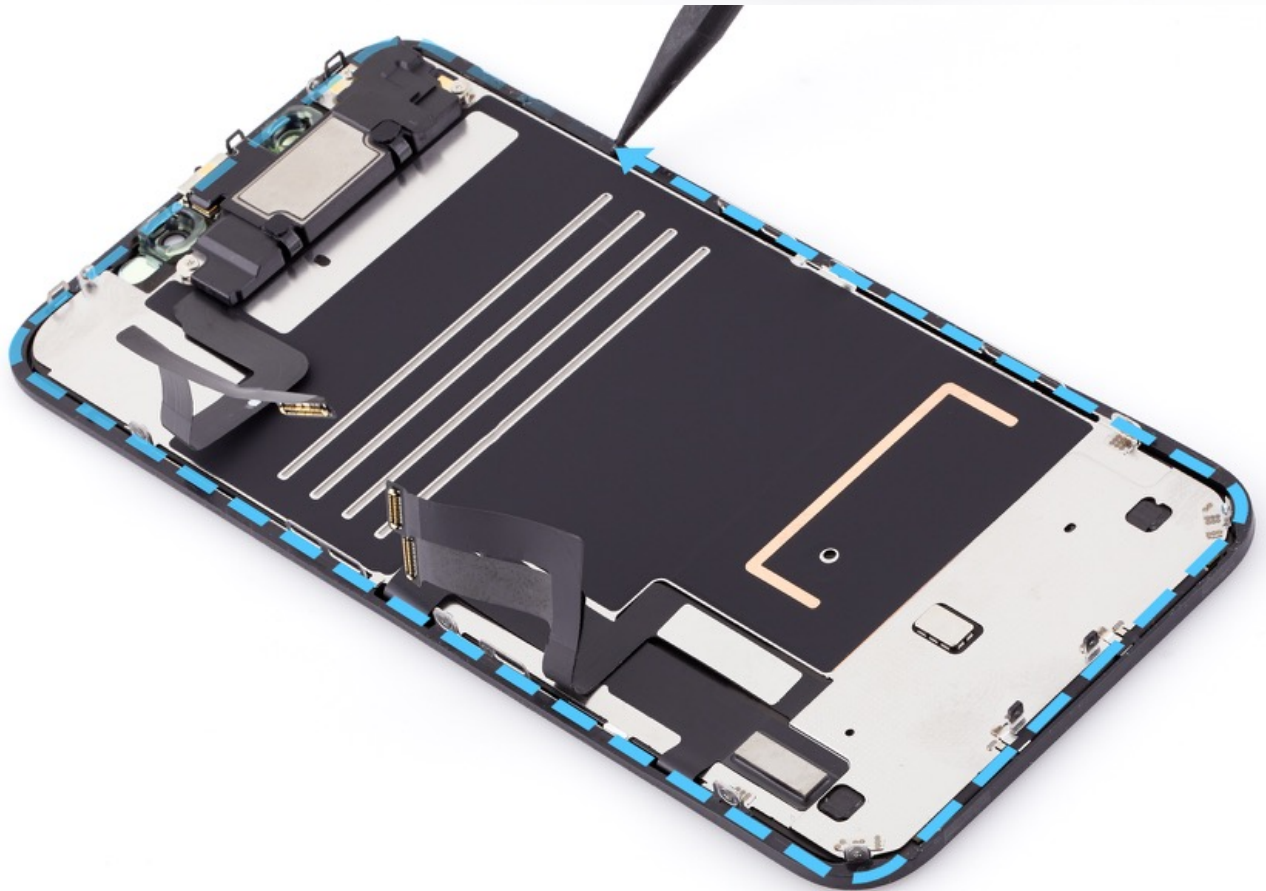
15. Use the torque driver to remove and discard five Microstix screws from the display cowling. Remove the cowling and save it for reuse.
Important: Avoid touching the TrueDepth cameras and nearby components.



16. Disconnect the three display flex connectors from the logic board.



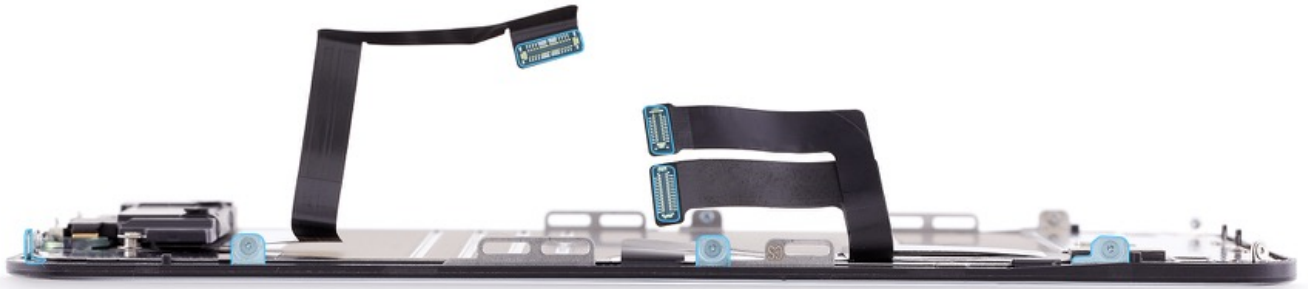
17. Remove the display assembly from the enclosure.
18. Use a black stick to remove adhesive residue from the display and the enclosure. Avoid touching the TrueDepth camera components and all grounding springs.
- Important:** Thoroughly clean the enclosure and the display to ensure a proper seal during reassembly.



19. Use IPA wipes to clean any adhesive residue from the enclosure and display.
Important: Do not use IPA wipes on the display as they may damage the display and affect image quality.

Steps For Reassembly

Important: Inspect the display clips and flex connectors for damage before reassembly. Verify that the clips are not bent or damaged.



Important: Make sure that all adhesive is removed from the display and enclosure before applying new adhesive.

1. With the tab on the left, align the display adhesive (923-03566) with the enclosure.

Important: Make sure the flexible release liner faces the enclosure.



2. Starting at the bottom edge of the enclosure, slowly remove the bottom release liner while pressing the adhesive onto the enclosure. Do not remove the top release liners.

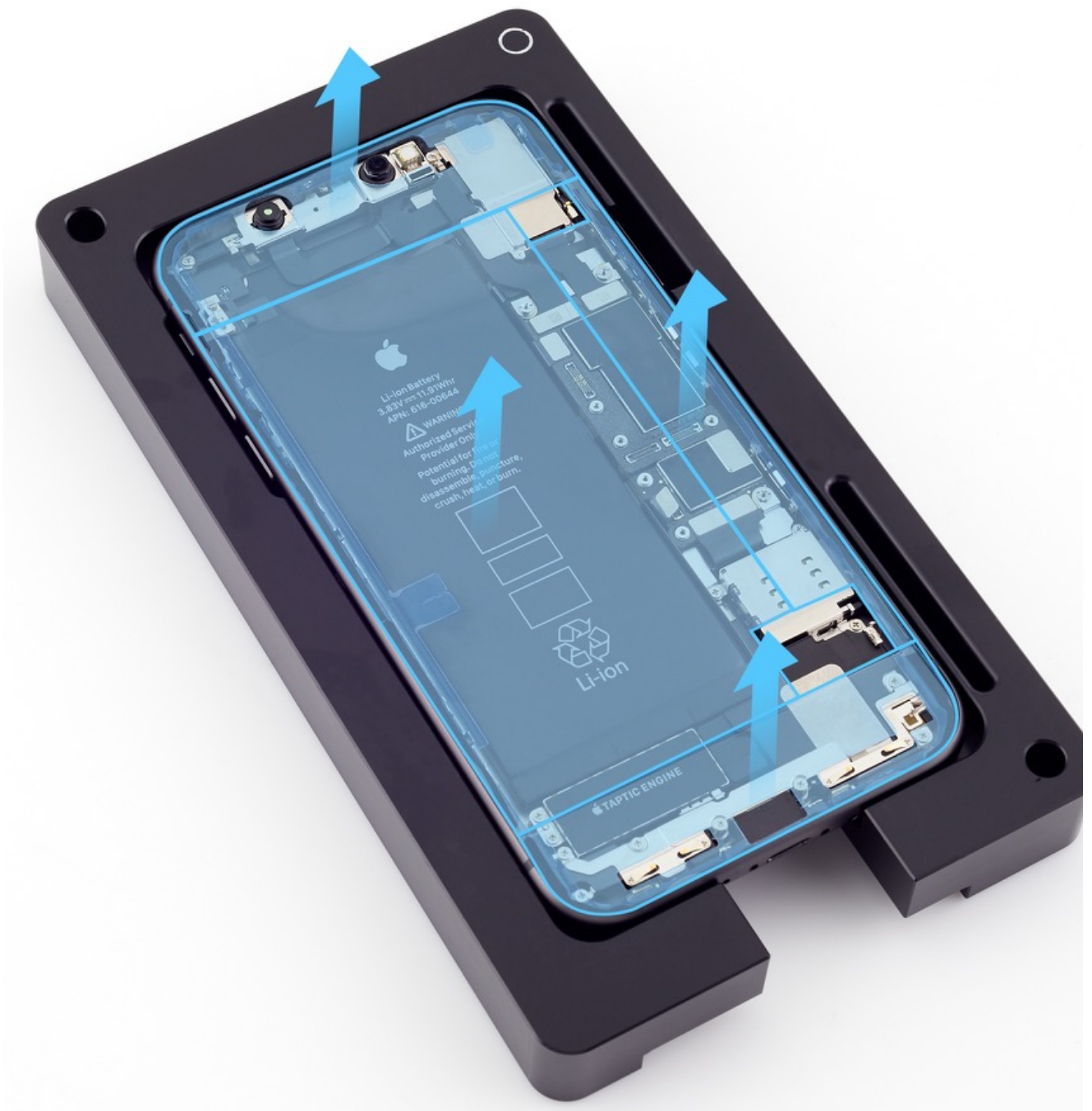


3. Use a black stick to adhere the display adhesive to the enclosure.



4. Remove the center section of the top release liner first, followed by the three sections running along the top, right, and bottom edges.

Important: Do not remove the remaining release liners.



5. Insert the iPhone into the repair tray. Then gently press along the edges of the display to secure the display to the suction cups.

Important: Do not press the back of the display to secure the display to the suction cup.



6. Connect the two display flex connectors (1) to the logic board. Route the sensor flex (2) between the battery and logic board and connect it to the logic board. Apply even pressure along the entire length of each connector to ensure proper seating.



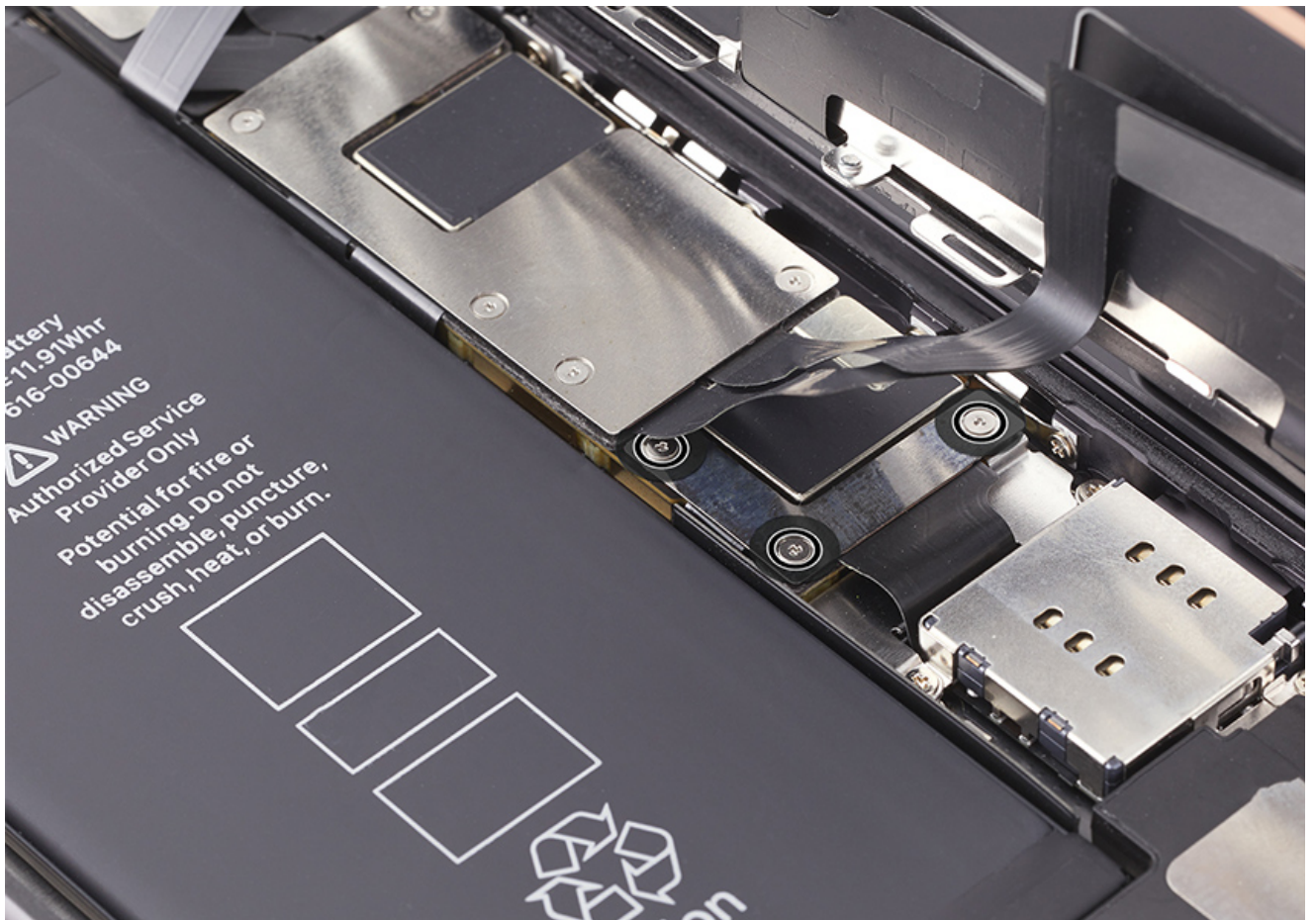
7. Reinstall the display cowling and use the black torque driver and Microstix bit to install five new screws (923-01972) into the display cowling.



8. Connect the battery connector to the logic board.



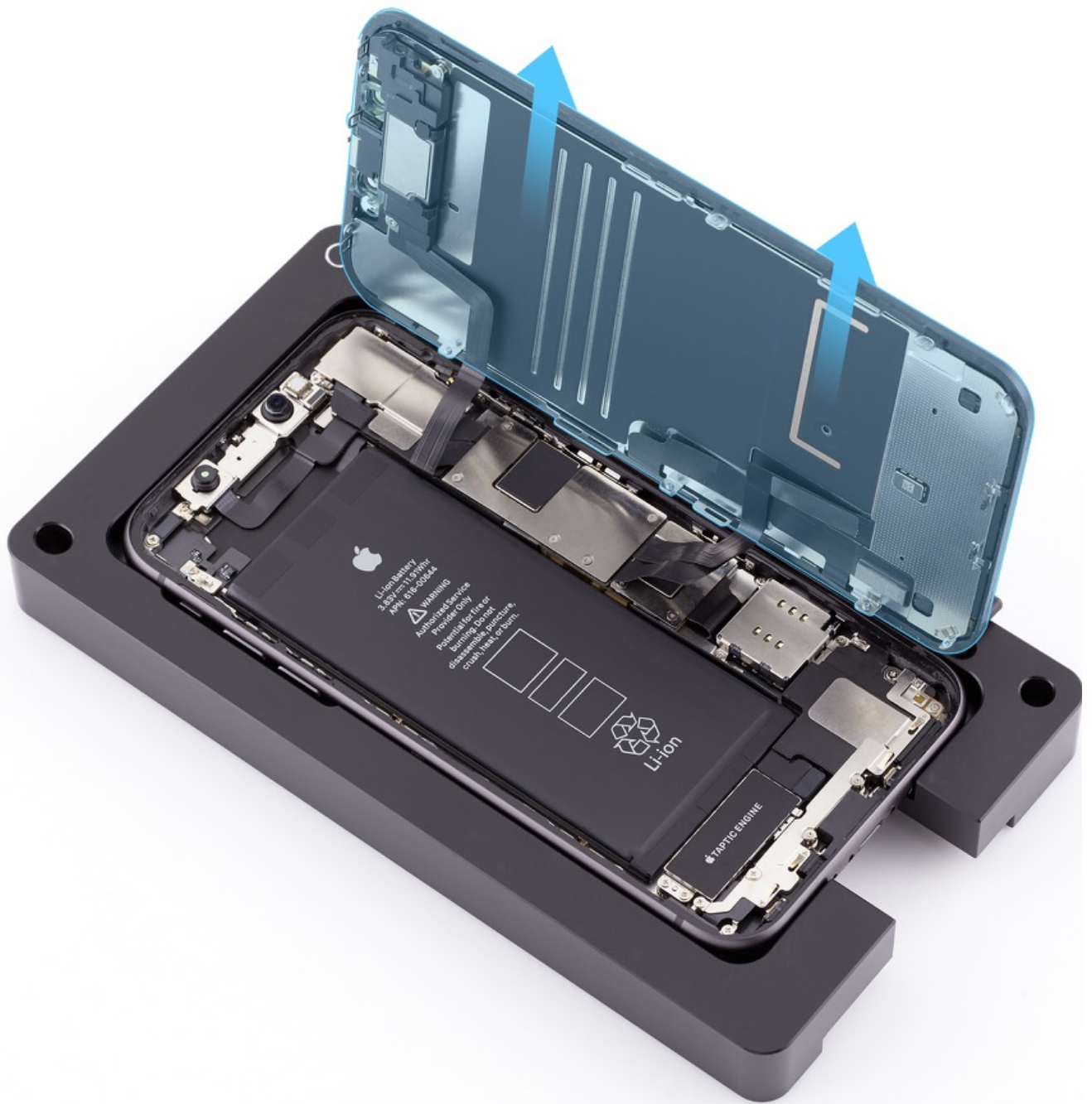
9. Reinstall the battery cowl and use the black torque driver and Microstix bit to install three new trilobe screws (923-01972) into the battery cowl.



10. Peel the release liner in a counterclockwise direction in the order shown.
Important: Avoid touching the TrueDepth camera components.



11. Inspect the display adhesive to make sure it is in the correct position and not damaged or wrinkled.
12. Release the suction cups from the display. Lift the display slightly to clear the grounding clip.



13. Remove the suction cups, tip the display to the left, align the clips, and place the display on the enclosure.



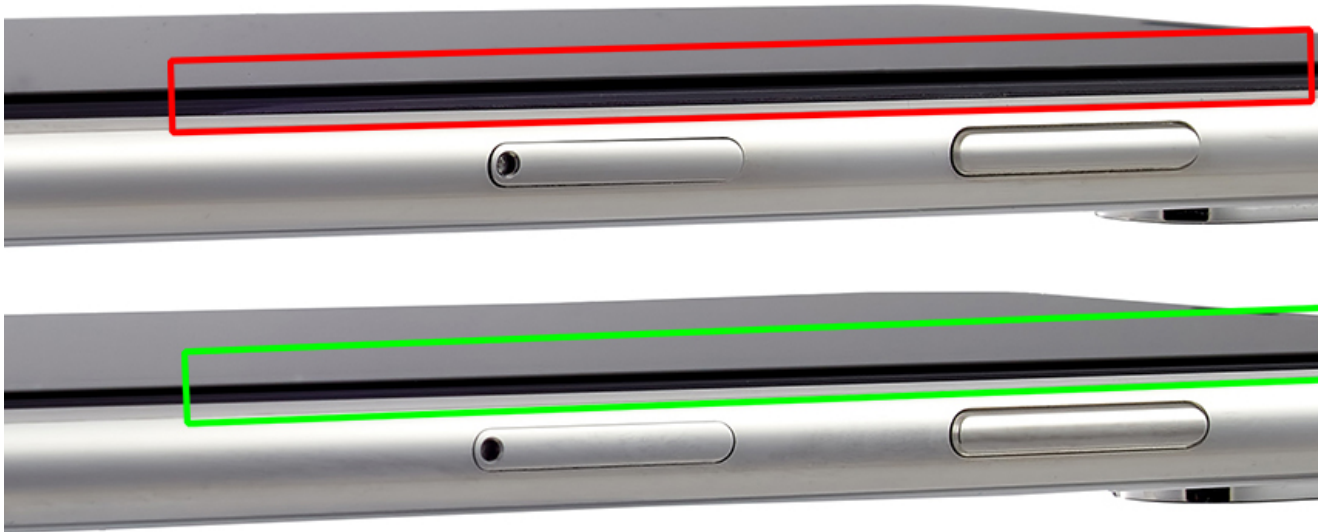
Warning: If the battery is dented, punctured, swollen, or otherwise damaged, then stop the repair. Do not remove the

battery from the device. Reassemble the device and replace the whole unit.

14. Press all corners of the display simultaneously, then press along the edges of the display until you hear a click and the display is flush with the enclosure.



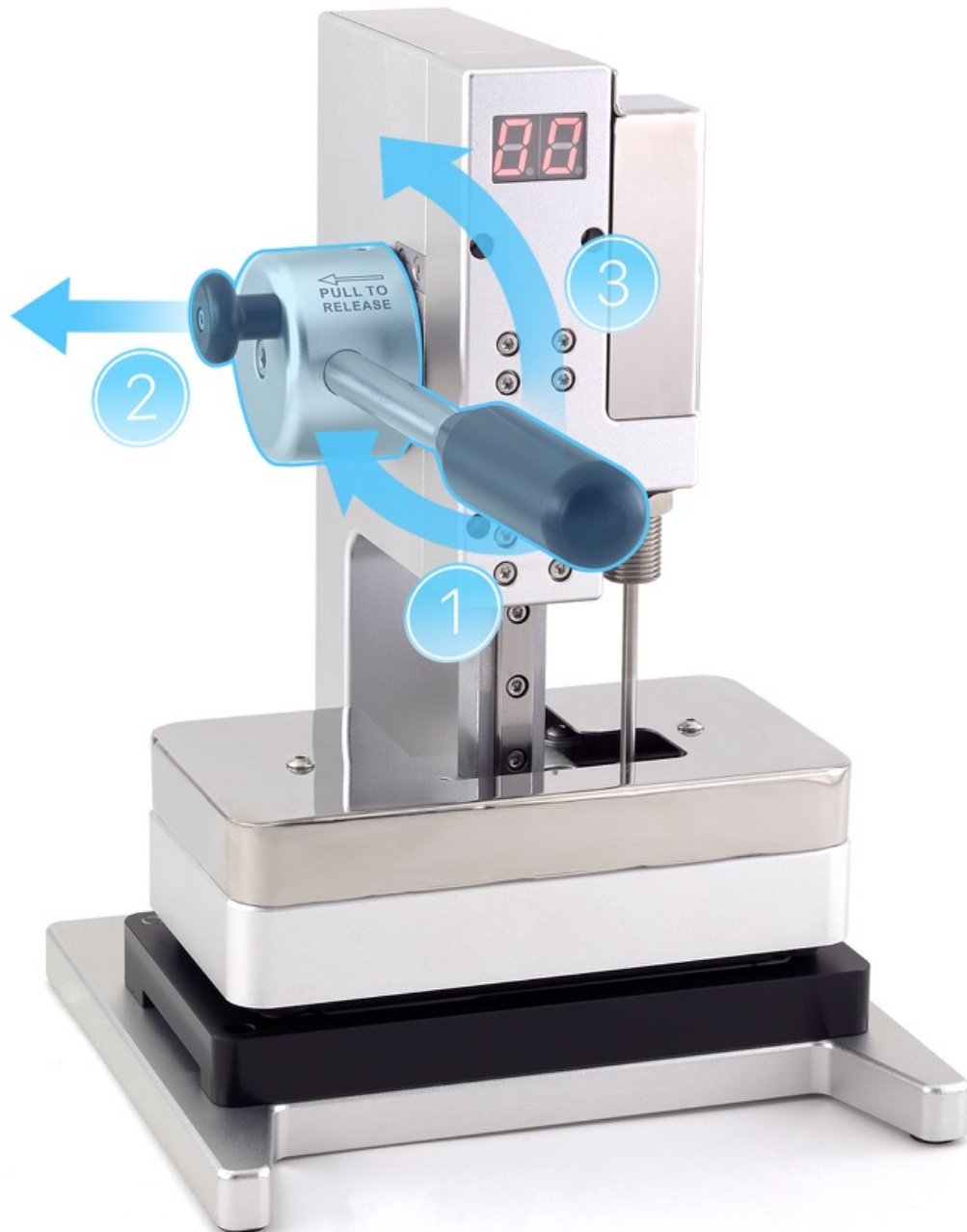
Important: Ensure the display flexes are not trapped between the display and enclosure. Check the edges of the device to make sure they are not raised. Feel the edge of the display for variations. If the display is not flush, then remove the display, check the flexes for damage, and repeat reassembly steps.



15. Place the iPhone in the Display Press and pull the lever down until the press locks.
Important: Use the Display Press to ensure a proper seal. Display calibration may fail if you do not complete this step.



16. Wait until the press timer beeps, then hold the lever down slightly (1), pull the release knob (2), and lift the lever up (3).
Important: Use the Display Press to ensure a proper seal. Display calibration may fail if you do not complete this step.



17. Remove the iPhone from the press.
18. While the iPhone is still in the repair tray, use the gray torque driver and security bit to install two new security screws, one on each side of the Lightning connector. Lightly press down on the display near the lightning connector to help ensure the screws sit flush. If the screws do not sit flush, then remove and discard the screws, and replace with new screws. If the new screws still do not sit flush, then remove and reinstall the display.
 - 923-02944 (black)
 - 923-02945 (all other colors)

18.



19. **Important:** Check iPhone operation using the steps in [Functional Test](#).

iPhone 11 Replace Display Assembly

First Steps

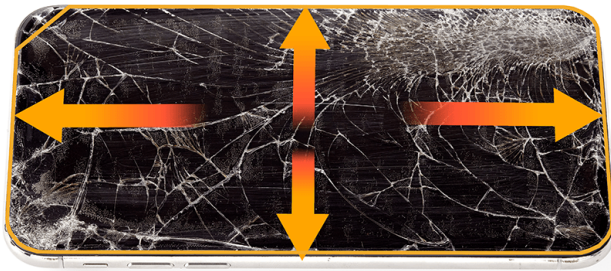
- Only Apple-certified technicians should perform this procedure.
- Remove all cases and screen protectors from the device.
- Follow electrostatic discharge (ESD) precautions.
- Turn off the device.
-



Warning: If the enclosure is separated due to a swollen battery, stop the repair. Do not remove the battery from the device. Replace the whole unit.

Warning: If the display glass is broken, put on safety glasses and material handling gloves. Use a vacuum cleaner to remove all glass shards from the workspace and display. Affix a protective display cover or packing tape to the display before removal to prevent injury or scattering of glass. Do not install the protective display cover or tape over the edge of the display.

When installing a 6.1-inch Display Protective Cover (923-02670), firmly press the cover onto the broken display to remove air bubbles and work the adhesive into the cracks in the glass. Let the cover settle into place for up to 12 minutes for more damaged displays before attempting to remove the display. The longer the protective display cover is left on the display, the stronger the bond between the cover and the broken glass.



If the back glass is broken, adhere a 6.1-inch Back Protective Cover (923-03569) before attempting a repair. If the protective cover does not adhere to the iPhone or if there is no glass for the film to adhere to, do not attempt a repair. Devices without back glass and devices that the back cover cannot adhere to will require a whole unit replacement.

Then place the iPhone in the 6.1-inch support frame (923-03575) before attempting to open the device. If the device does not fit in to the support frame, do not attempt a repair. Devices that do not fit into the support frame will require a whole unit replacement.



Important:

- Display calibration software requires a publicly released version of iOS. For devices running beta or SDK versions of

iOS, perform a recovery mode restore before attempting display replacement and calibration.

- Check for bezel damage that would interfere with proper seating of the display assembly. If bezel damage is present, replace the whole unit.



Tools

- Bar code scanner

Steps For Removal

1. Perform the [Open Device](#) procedure.

Steps For Reassembly

Remove all packaging from the replacement display.

Use a replacement display and follow the reassembly steps in [Open Device](#).

Important: Display calibration is required after a display assembly replacement.

Note: The serial number field is not case sensitive.

4. If calibration fails, perform the following steps:
 - a. Follow software prompts.
 - b. Reset the iPhone.
 - c. If calibration fails again, reseal the cables and attempt calibration again.
 - d. If resealing does not resolve the issue, replace the whole unit. Note the failure in the repair and process the part as DOA.
5. **Important:** Check iPhone operation using the steps in [Functional Test](#).

RepairCal Procedure

Only Apple-certified technicians should perform this procedure.

RepairCal software is intended to calibrate the device after repair for iPhone 6s and later except iPhone SE.

Follow the RepairCal procedure after a display replacement for iPhone 6s and later except iPhone SE.

Follow the RepairCal procedure after a battery replacement for iPhone XS, iPhone XS Max, and iPhone XR only.

Note: If RepairCal is not run, the customer may see a message on their iPhone indicating the battery or display could not be verified.

Important:

- The RepairCal software requires that iOS 10.3 or later is installed on the device. If the device is not running iOS 10.3 or later, then update the software before performing the repair. The RepairCal software also requires a publicly released version of iOS. For devices running beta or SDK versions of iOS, perform a recovery mode restore before attempting display replacement and calibration.
- If the device has a pending update, delete or complete the update prior to calibration. If possible, complete the update with the customer.
- **iPhone X, iPhone XS, and iPhone 11 Pro only:** Verify that a speaker port cover (923-02296) is placed on the device before running RepairCal. Completely cover the speaker port to avoid any loud sounds during calibration.
- The calibration process is very sensitive to vibration. Do not do any of the following during calibration:

- Place any objects on top of the device
- Move or touch the device
- Vibrate or shake the bench
- Play loud music near the device

Required Tools

- Mac with RepairCal software
- Apple Lightning to USB Cable (0.5 m, 1 m, or 2 m) **Important:** Do not use any Apple USB-C to Lightning Cable with iMac or Mac mini.
- Apple 5W or 12W USB Power Adapter
- Repair tray (appropriate for the size of the device)

Preparation

- Make sure the iPhone battery has a charge greater than 20 percent before attempting to calibrate the device.
- The iPhone must be in recovery mode displaying the Connect to iTunes screen. If the device freezes on the Apple logo screen, then perform the following steps:
 1. Reset the iPhone.
 2. Perform an update or restore using iTunes.
 3. If the iPhone is in recovery mode and cannot be restored, then replace the whole unit.
- If the iPhone does not turn on, then perform the following steps:
 1. Reset the iPhone.
 2. Connect iPhone to a known-good USB charger.
 3. Open the device and reseat the battery connector and display connectors.

Important: Do not attempt to calibrate an iPhone that turns on but has a black screen. If a display replacement did not resolve the issue, then follow the troubleshooting steps for the original issue.

Procedure

1. Launch the RepairCal software, located in the Applications folder on the Mac. **Note:** If you receive an error, then quit the RepairCal software, restart the computer, and relaunch the software.
Important: Before connecting the iPhone to the Mac, make sure the RepairCal app is set to the correct repair type that matches the components replaced during the repair. Incorrect repair selection will result in a test failure. Choose the appropriate components in the Repair menu.
 - **Display:** Use Display when a display has been replaced. This calibrates the 3D Touch on replacement display only.
 - **Battery:** Use Battery when a battery has been replaced on iPhone XS, iPhone XS Max, and iPhone XR only.
 - **Display and Battery:** Use Display and Battery when a display and battery have been replaced on iPhone XS, iPhone XS Max, and iPhone XR only.
2. Remove the protective film from the new display. Hold the iPhone by the edge and thoroughly clean the iPhone display with a lint-free cloth. Visually verify the device has no cracks, scratches, or anomalies. **Note:** For iPhone X, iPhone XS, and iPhone 11 Pro only, verify that a speaker port cover (923-02296) is placed on the device before running calibration.

Completely cover the speaker port to avoid any loud sounds during calibration. Refer to the model-appropriate "Replace Display Assembly" article for details.

3. Place the device in the repair tray. Connect the device to the Mac using a Lightning to USB Cable. **Note:** Display calibration will take approximately three to eight minutes depending on device type and network bandwidth. If the device fails calibration, then rerun the calibration.
4. When calibration is complete, the RepairCal software screen will display Passed or Failed.
5. Disconnect the Lightning to USB Cable and remove the device from the repair tray.

Interpret the calibration results:

If the device passes calibration, then run the recommended AST 2 test suites and the Post-Repair Diagnostic.

If the device fails calibration, perform the following steps:

Follow software prompts.

Reset the iPhone. **Note:** The phone may be in recovery mode. This is expected. Attempt calibration again with the phone in recovery mode.

Attempt calibration again.

If the device again fails to calibrate, then reseal the cables and reattempt calibration. If the device still fails to calibrate and does not prompt you to try a second replacement display, replace the whole unit. Note the failure in the repair and process the part as DOA.

iPhone 11 Camera

First Steps

- Perform the [Open Device](#) procedure.

Important:

- Only Apple-certified technicians should perform this procedure.
- Wear nitrile or lint-free gloves to prevent contamination of the camera lens.
- Avoid touching the TrueDepth Cameras and nearby components.
- When entering the serial number for the repair transaction, use the serial number of the smaller camera closest to the top of the enclosure.



Tools

1. Black torque driver (923-0248)
2. JCIS bit for crosshead screws (923-0246)
3. ESD-safe tweezers
4. Black stick (922-5065)
5. Nitrile or lint-free gloves



Steps For Removal

1. Use the torque driver and JCIS bit to remove and discard two crosshead screws from the camera cowl.
- Important:** Avoid touching the TrueDepth Camera components. Avoid damaging the grounding clip.



2. Lift the camera cowl up and toward the left to avoid damaging the cowl tabs. Save for reuse.



3. Disconnect the two camera flex connectors, then remove the camera from the enclosure.



Steps For Reassembly

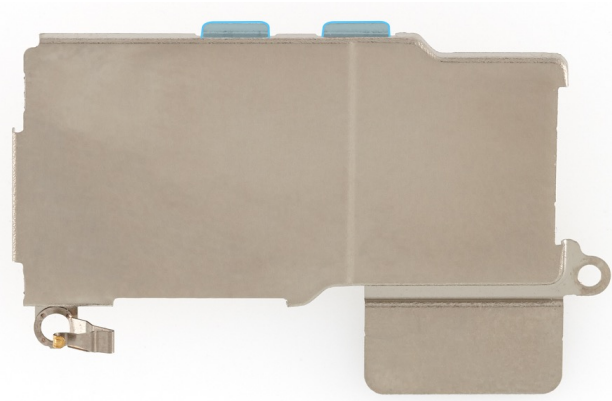
1. Put on gloves and keep the camera pointed down as you remove the protective lens cover from the replacement camera.



2. Seat in the camera in the enclosure.
3. Connect the camera flex connectors to the logic board.



4. Reinstall the camera cowling by fitting the tabs into the bracket on the right.



5. Use the black torque driver and JCIS bit to install two new crosshead screws (923-03513) into the camera cowling. Be careful not to damage the grounding spring.



6. Follow the reassembly steps in [Open Device](#).
7. Run the AST 2 Camera Image Quality suite to evaluate the camera image quality after the repair.
8. **Important:** Check iPhone operation using the steps in [Functional Test](#).

iPhone 11 Speaker

First Steps

- Perform the [Open Device](#) procedure.

Important:

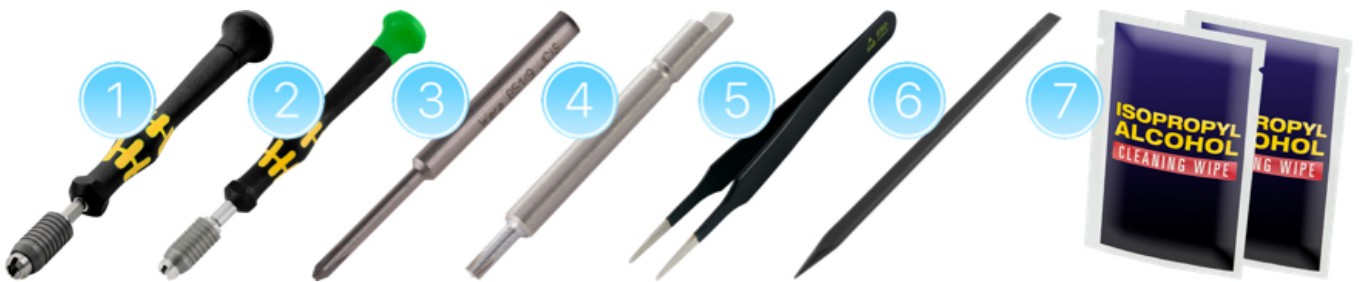
- Only Apple-certified technicians should perform this procedure.
- The speaker (923-03506) must always be replaced if removed from the enclosure.



Tools

1. Black torque driver (923-0248)
2. Green torque driver (923-00105)
3. JCIS bit for crosshead screws (923-0246)
4. Superscrew bit (923-02066)
5. ESD-safe tweezers

6. Black stick (922-5065)
7. Isopropyl alcohol (IPA) wipes



Steps For Removal

1. Use a torque driver to remove and discard five crosshead screws from the lower cowling. Remove the cowling and save for reuse.



2. Remove the foam sticker from the Taptic Engine cowling.



3. Peel back the rubber to gain access to the Taptic Engine cowling screw.
Important: Hold the rubber cover on the Taptic Engine flex cowling to prevent damage when removing the foam sticker. Remove and discard the screw. Remove the cowling and save for reuse.



4. Remove and discard the crosshead screw on the lower antenna flex connector. Carefully move the flex to the side.



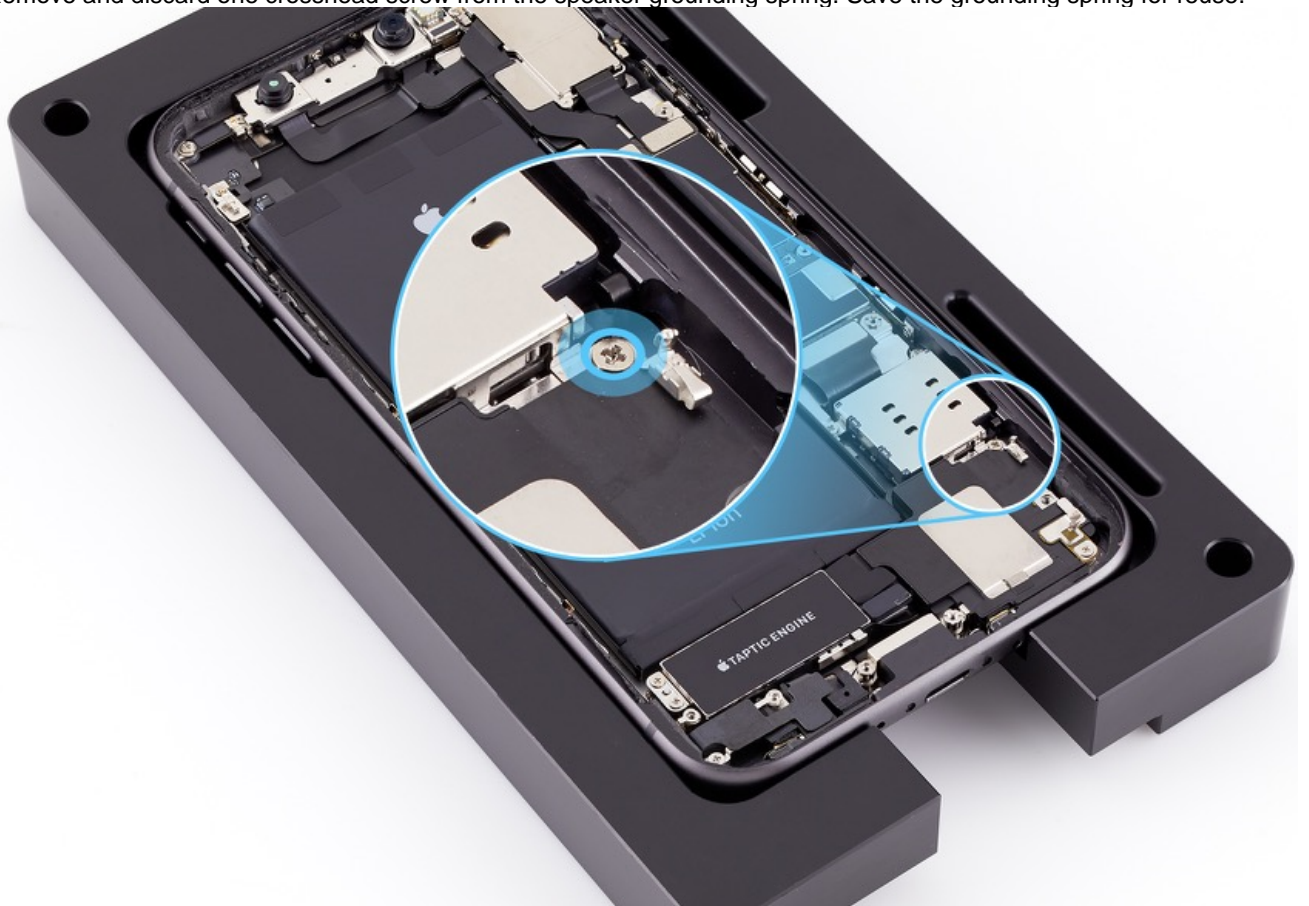
5. Remove and discard the two Superscrews at the bottom of the speaker.



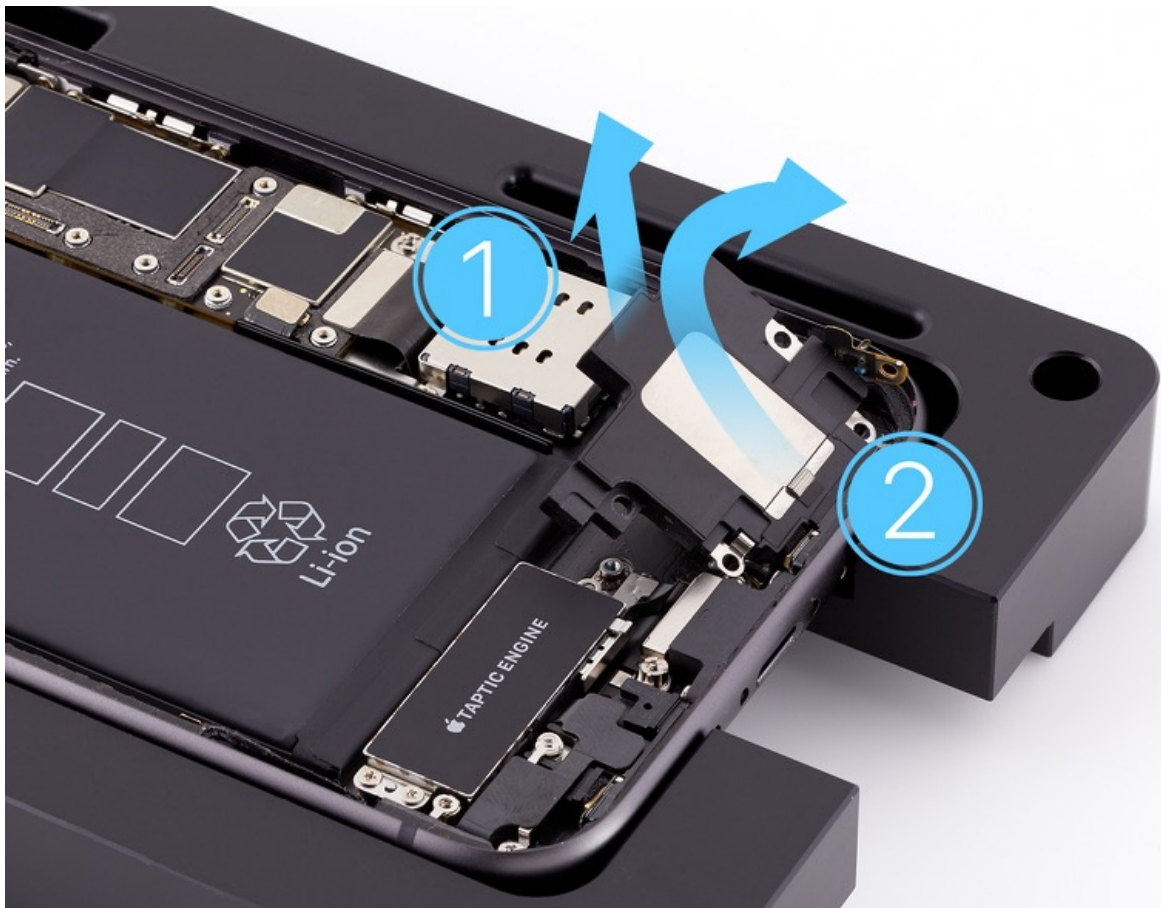
6. Remove and discard the crosshead screw on the left side of the speaker.



7. Remove and discard one crosshead screw from the speaker grounding spring. Save the grounding spring for reuse.



8. To remove the speaker from the enclosure, lift the speaker up (1) and to the right (2). Be careful not to damage the lower antenna flex.

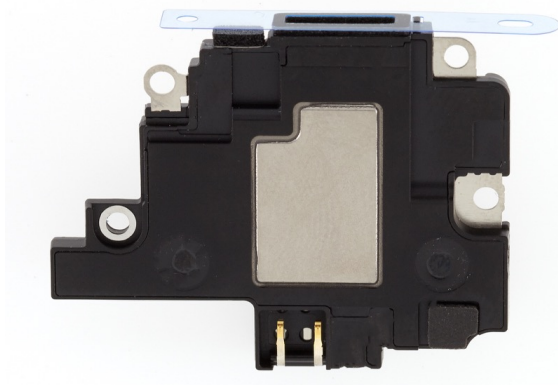


9. Use an IPA wipe to gently clean adhesive residue from the speaker port in the enclosure.

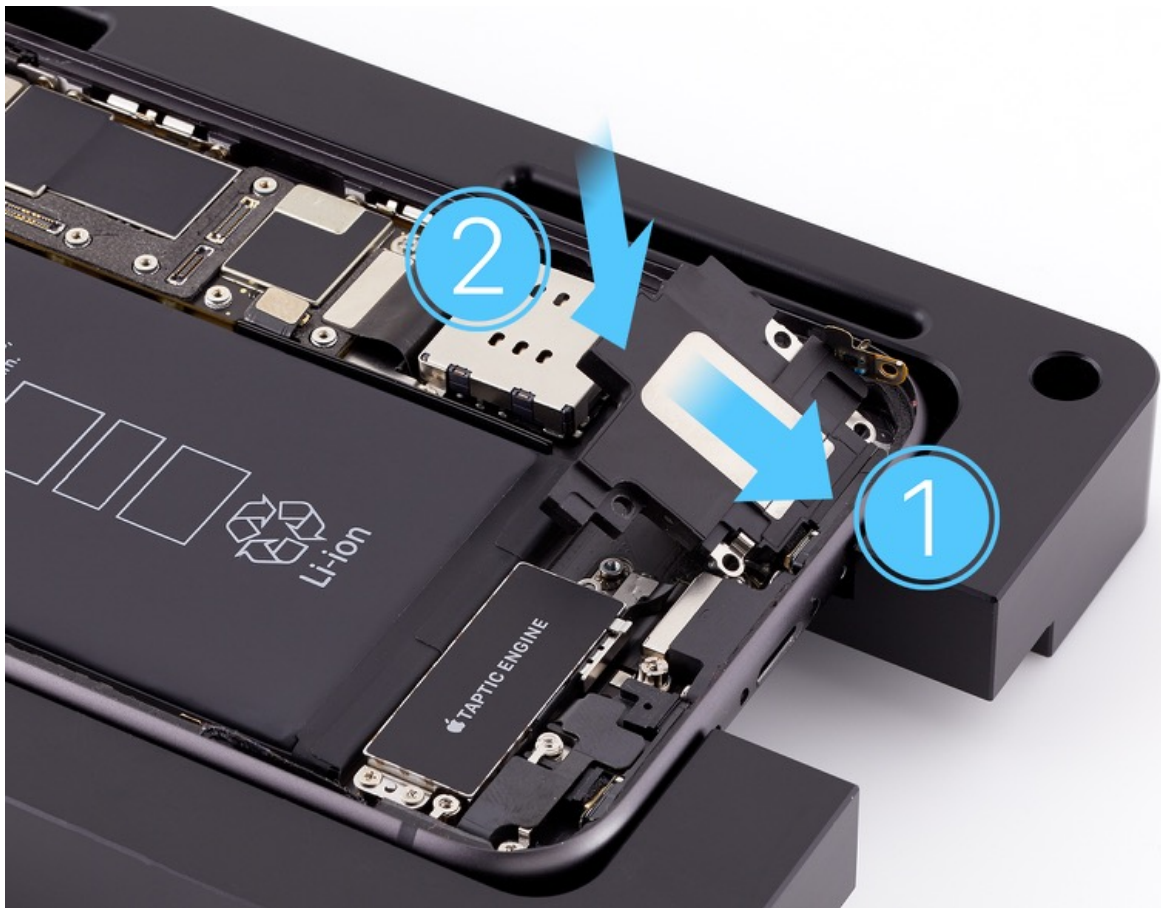
Steps For Reassembly

Important: Use a new speaker (923-03506) each time a speaker is removed.

1. Remove the liner from the speaker foam gasket.



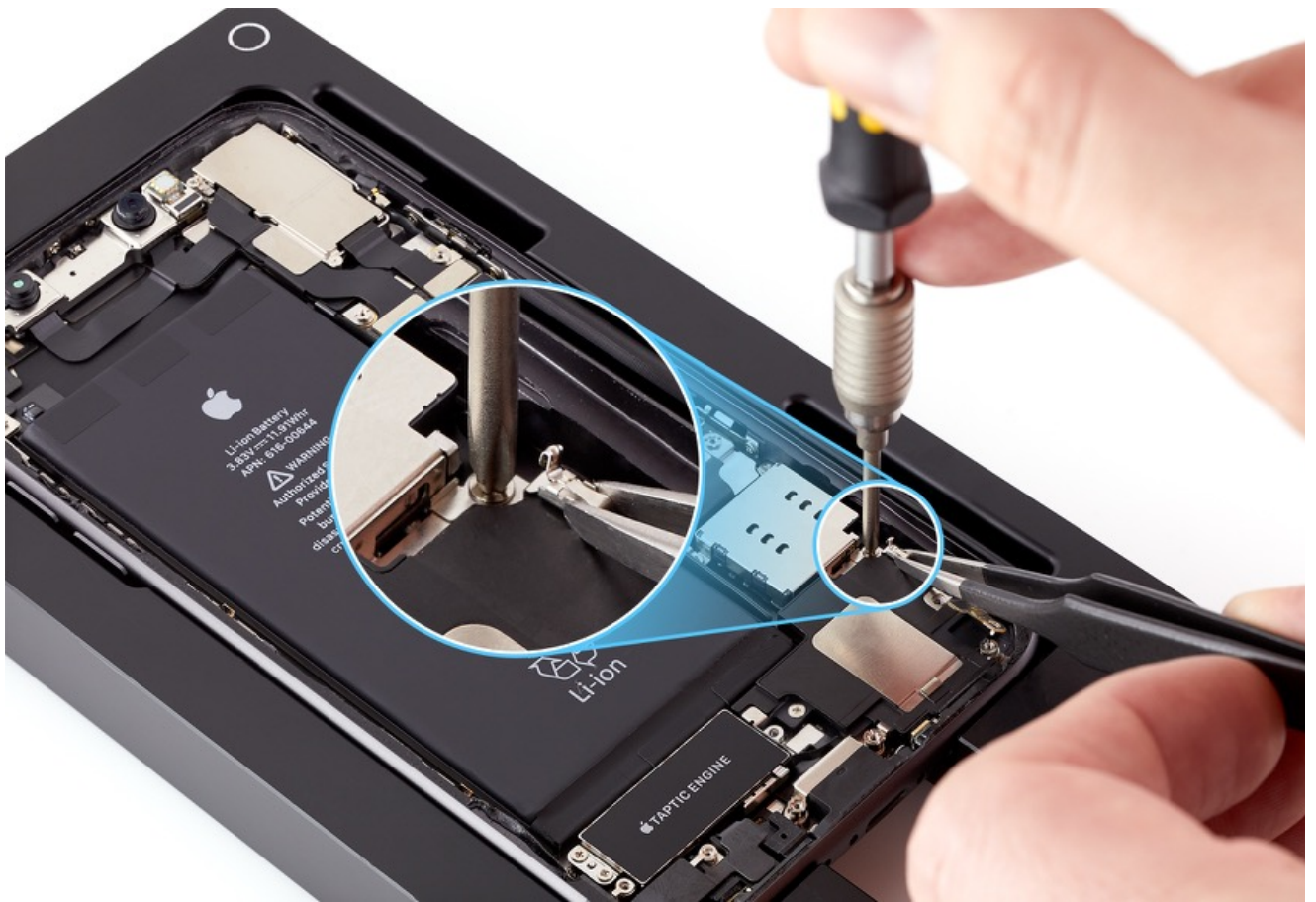
2. Align the pin on the speaker with the pinhole in the enclosure.
3. Carefully place the speaker into the enclosure. Do not touch the bottom of the enclosure with the adhesive on the speaker foam. Press and hold the speaker against the bottom of the enclosure to activate the adhesive.



4. Use the green torque driver with the JCIS bit to install a new crosshead screw (923-02611) in the upper left corner of the speaker. Then use the green torque driver to install two new Superscrews (923-03508, right; 923-03509, left) at the bottom of the speaker.



5. Place the grounding spring (923-03709) on the speaker. Use the torque driver (green) and JCIS bit to install one new crosshead screw (923-02622). Hold the ground spring in place with ESD-safe tweezers while securing the grounding spring.



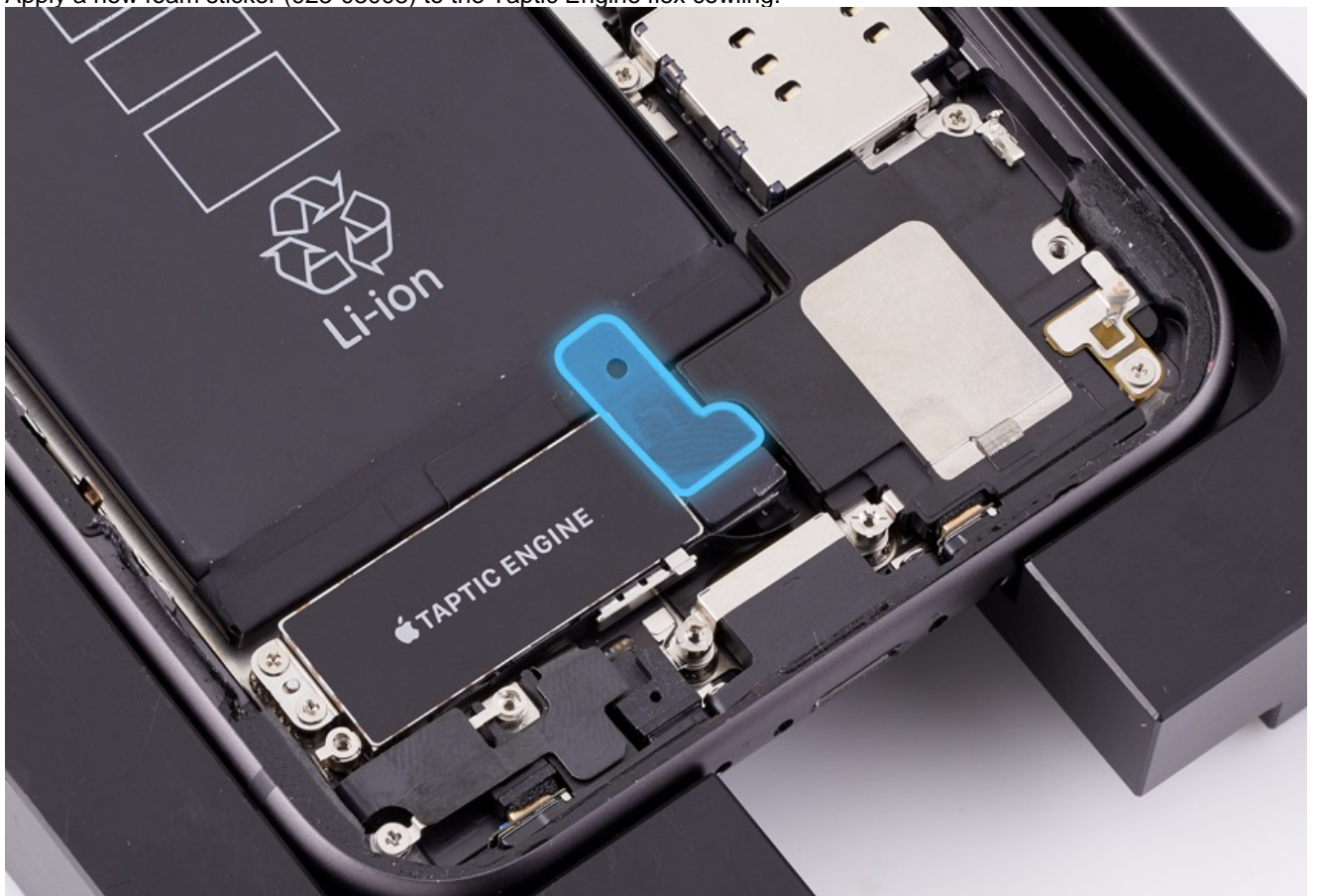
6. Fold the lower antenna flex back in place and use a green torque driver and JCIS bit to secure it with a new crosshead screw (923-02618).



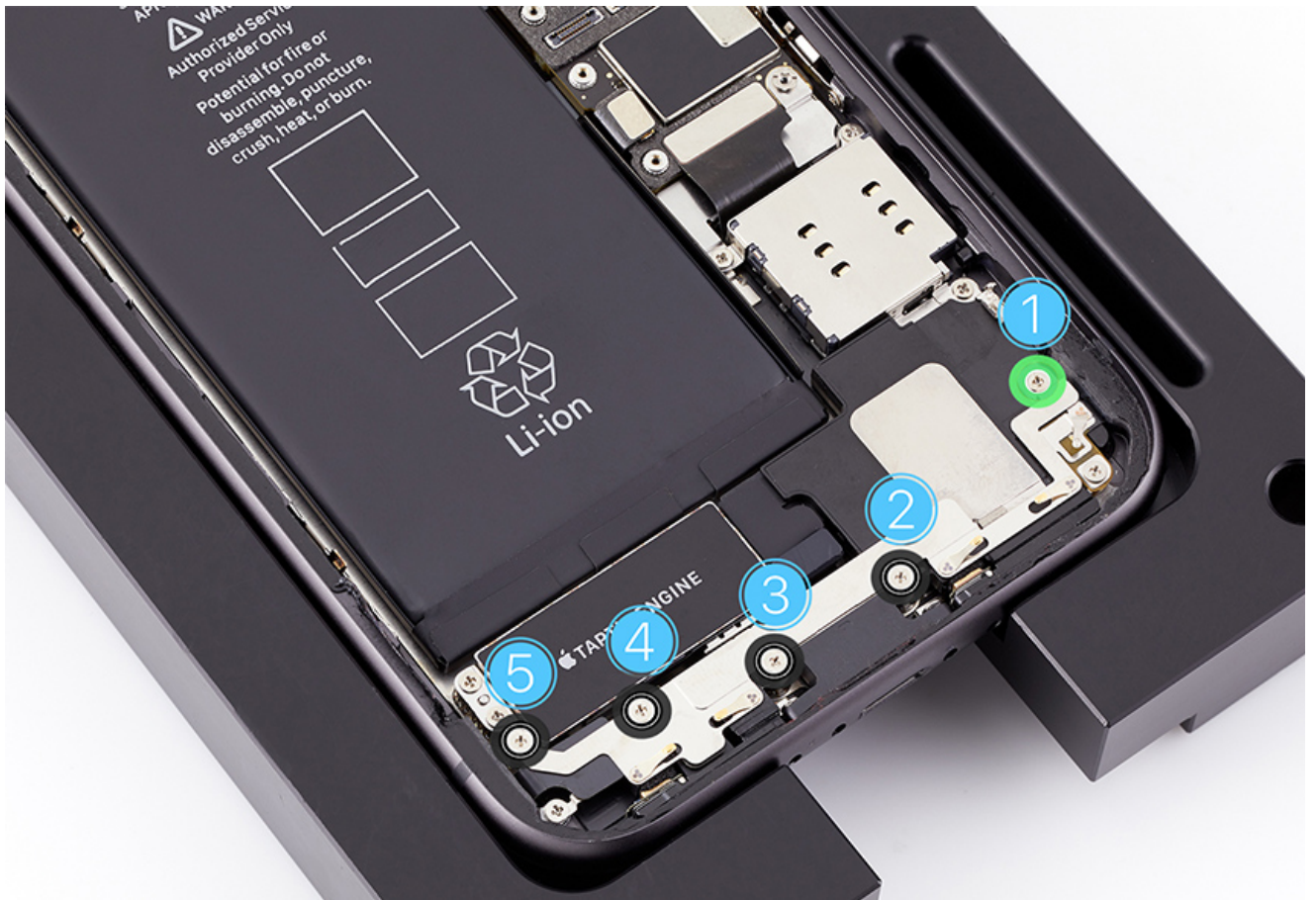
7. Reinstall the Taptic Engine flex cowling. Fold back the rubber cap and use the the gray torque driver and JCIS bit to install one new crosshead screw (923-03035).



8. Apply a new foam sticker (923-03008) to the Taptic Engine flex cowling.



9. Use the green torque driver and JCIS bit to install one new crosshead screw (923-02622) in the lower cowling. Use the black torque driver and JCIS bit to install three new crosshead screws in position 2, 3, and 5 (923-02618) and one new crosshead screw in position 4 (923-03511) in the lower cowling.



10. Follow the reassembly steps in [Open Device](#).
11. **Important:** Check iPhone operation using the steps in [Functional Test](#).

iPhone 11 Taptic Engine

First Steps

- Perform the [Open Device](#) procedure.

Important: Only Apple-certified technicians should perform this procedure.



Tools

1. Black torque driver (923-0248)
2. Gray torque driver (923-00738)
3. Green torque driver (923-00105)
4. JCIS bit for crosshead screws (923-0246)
5. ESD-safe tweezers

6. Black stick (922-5065)



Steps For Removal

1. Use the torque driver and JCIS bit to remove and discard crosshead screws from the lower cowling. Lift off the lower cowling and save for reuse.



2. Remove the foam sticker from the Taptic Engine flex cowlings.
Important: Hold the rubber cover on the Taptic Engine flex cowlings to prevent damage when removing the foam sticker. Lift the rubber cover on the Taptic Engine flex cowlings to gain access to the screw and remove the screw and discard it. Remove the cowlings and save for reuse.



3. Disconnect the Taptic Engine flex connector.



4. Use the torque driver and to remove and discard two crosshead screws from the Taptic Engine. Remove the Taptic Engine.



Steps For Reassembly

1. Position the Taptic Engine over the enclosure and connect the Taptic Engine flex connector. Place the Taptic Engine into the enclosure.



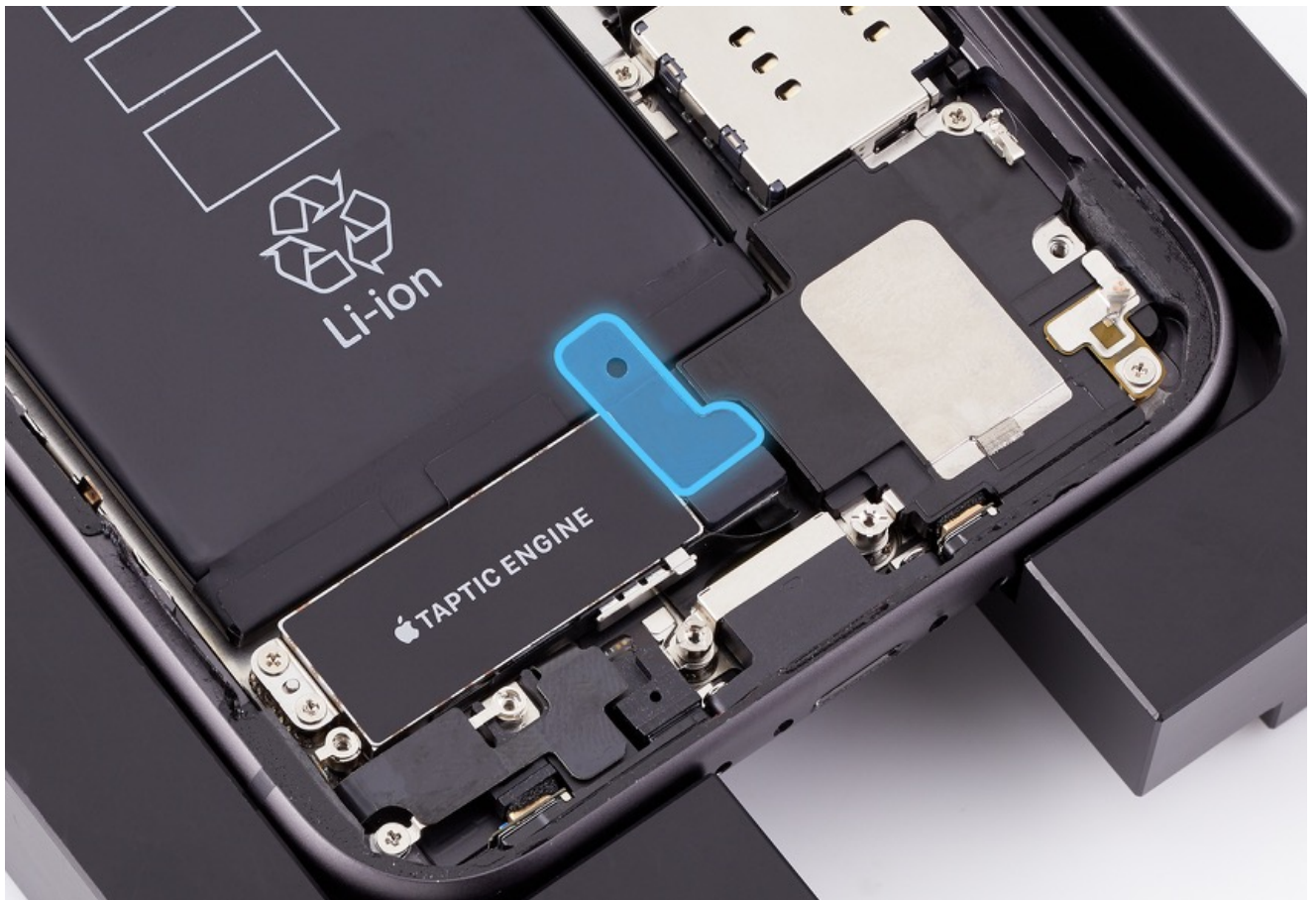
2. Use the gray torque driver and JCIS bit to install two new crosshead screws (923-03035) into the Taptic Engine.



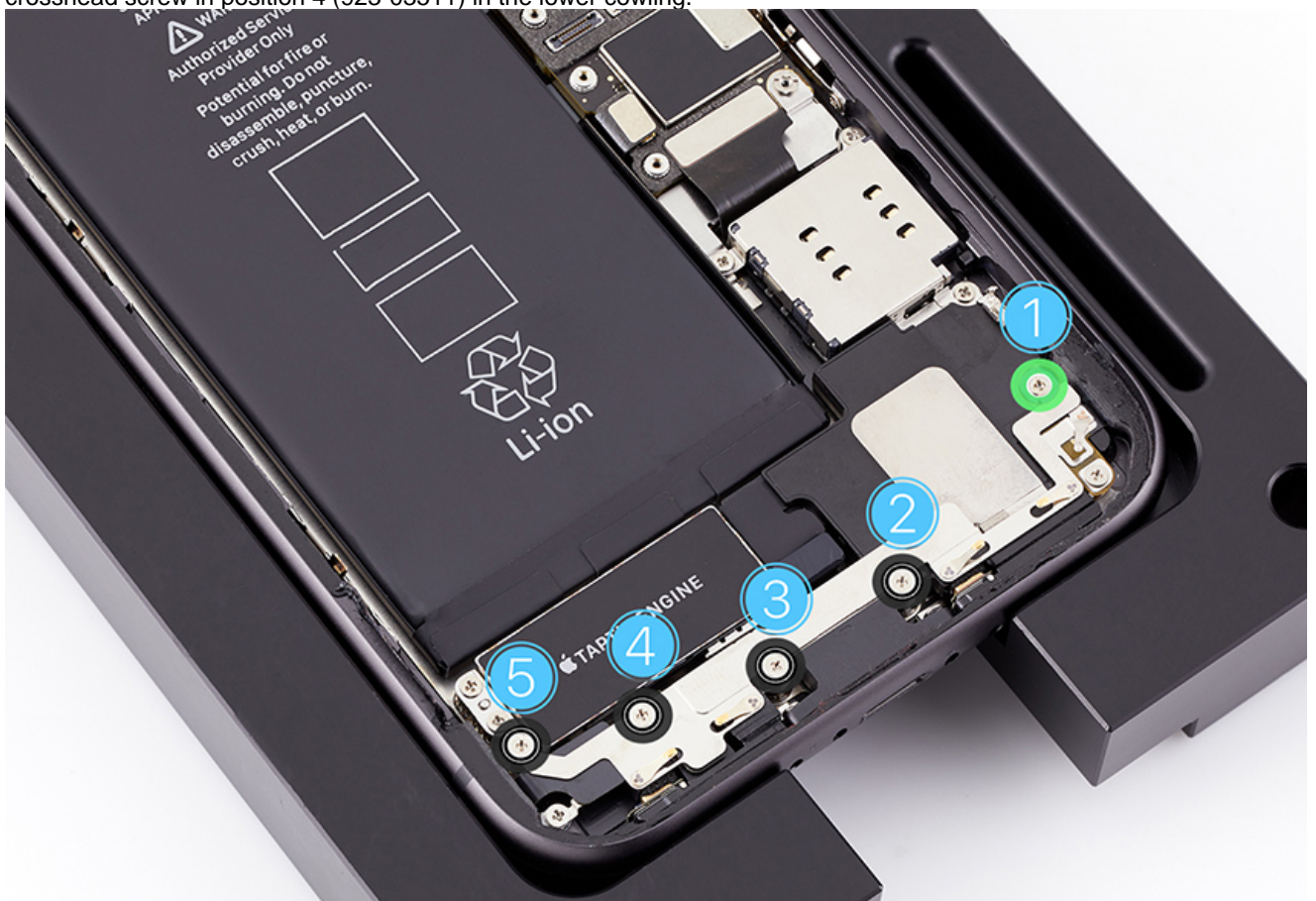
3. Place the Taptic Engine flex cowling over the Taptic Engine flex connector.
4. Lift the rubber cover on the Taptic Engine flex cowling to gain access to the screw boss. Use the torque driver (gray) and JCIS bit to install one new crosshead screw (923-03035) into the Taptic Engine flex cowling.



5. Apply the new foam sticker to the Taptic Engine flex cowling.



6. Use the green torque driver and JCIS bit to install one new crosshead screw (923-02622) in the lower cowling. Use the black torque driver and JCIS bit to install three new crosshead screws in position 2, 3, and 5 (923-02618) and one new crosshead screw in position 4 (923-03511) in the lower cowling.



7. Follow the reassembly steps in [Open Device](#).
8. **Important:** Check iPhone operation using the steps in [Functional Test](#).

iPhone 11 Battery

First Steps

- [Open Device](#) procedure.
- Remove the [Taptic Engine](#).

Important: Only Apple-certified technicians should perform this procedure.



Warning:

- If the device contains a non-Apple battery, first refer to [Non-Apple Battery Discharge Procedure](#).
- If the battery is dented, punctured, swollen, or otherwise damaged, then stop the repair. Do not remove the battery from the device. Reassemble the device and replace the whole unit.
[Enclosure separation due to expanded or swollen battery for iPhone.](#)
- Do not reuse or reinstall a loose battery or a battery that has been removed. Replace it with a new battery. If a new battery is unavailable, replace the whole unit.



Location of battery adhesive



Tools

1. ESD-safe tweezers
2. Black stick (922-5065)
3. Isopropyl alcohol (IPA) wipes
4. 6.1-inch repair tray (923-03572)
5. iPhone Battery Fixture (923-02657)

6. Nitrile or lint-free gloves

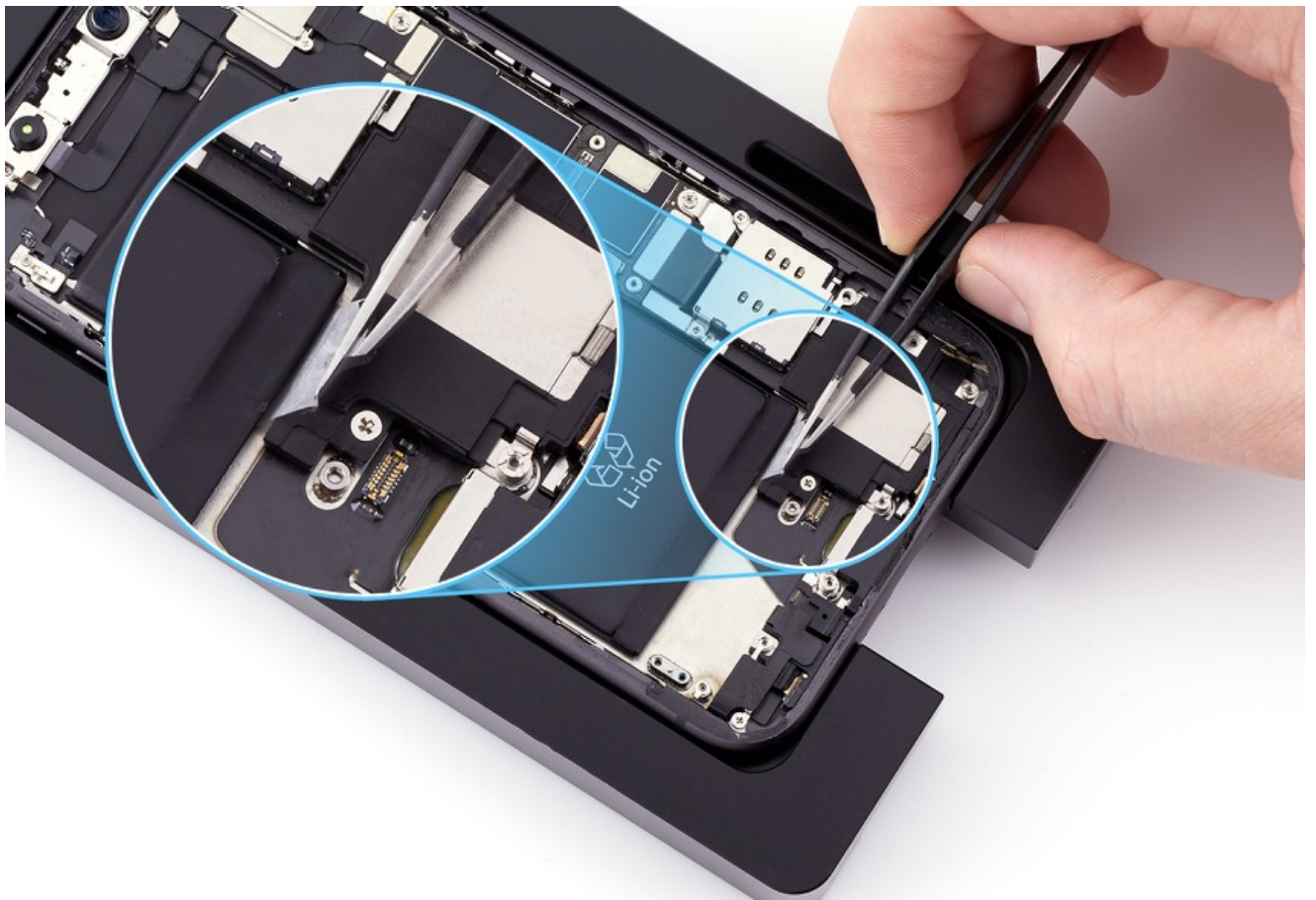


Steps For Removal

1. Use ESD-safe tweezers to gently lift the battery adhesive tabs from the battery.



2. Hold down the battery with one hand. With the other hand, use ESD-safe tweezers to grasp one battery adhesive tab and slowly pull it toward the bottom of the device. Remove the tabs from left to right.



3. Twist the tweezers to wrap the battery adhesive tab around it. As the battery adhesive strip extends, continue to twist and slowly pull it with the tweezers.

Important: Avoid pulling the adhesive strips against components or screws.

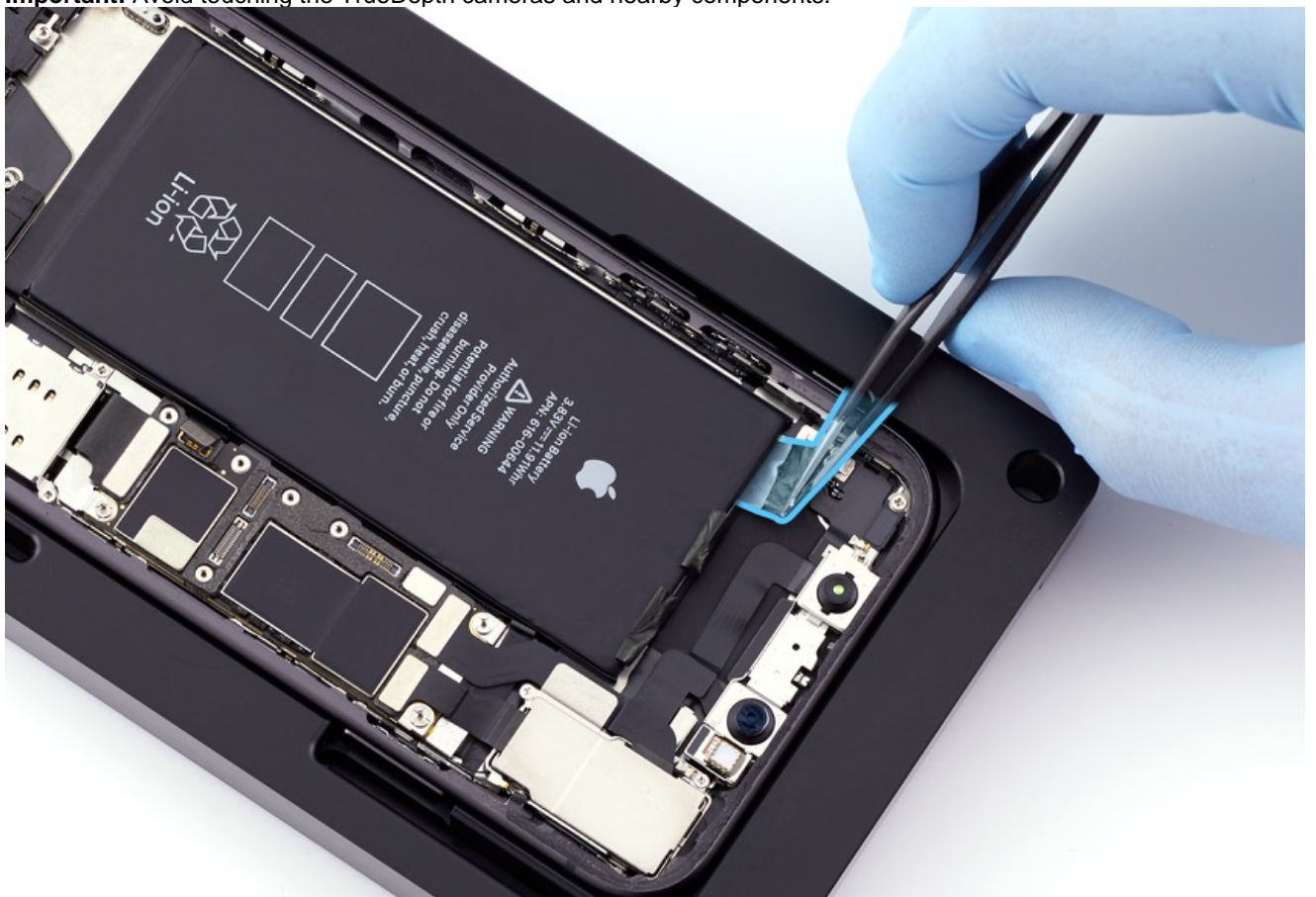


Warning: If a battery adhesive strip breaks, then use ESD-safe tweezers to try to retrieve it. If the battery adhesive strip cannot be retrieved, then attempt to remove the remaining ones. If the remaining adhesive strips cannot be removed or retrieved, then replace the whole unit. Do not use tools to pry the battery.

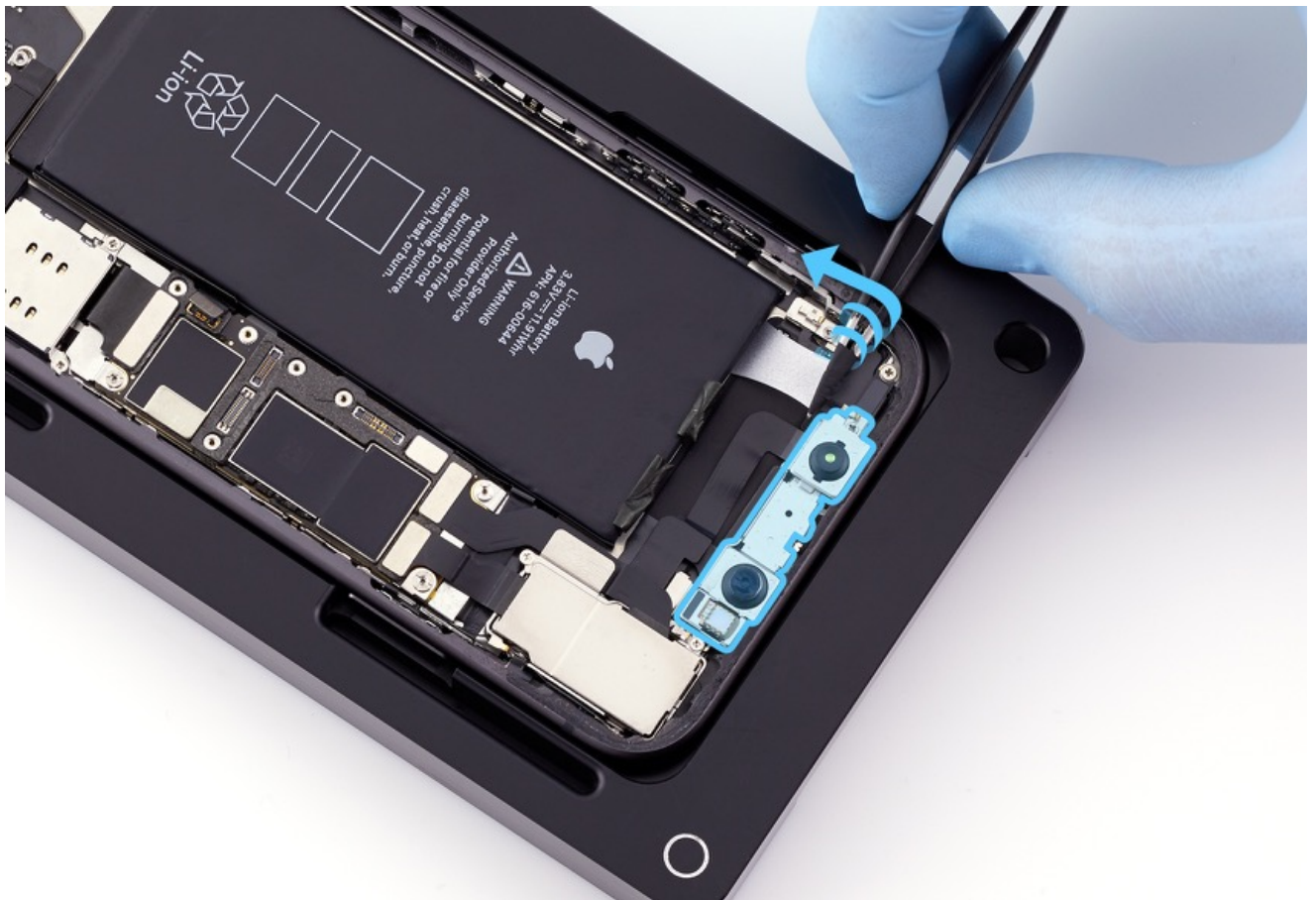
4. Continue to pull slowly until the battery adhesive strip releases.
5. Repeat steps 2 through 4 with the remaining adhesive strips.
Caution: Pull the last strip toward the left, away from the speaker. If the tab breaks, remove the speaker and use ESD-safe tweezers to try to retrieve it.



6. Put on nitrile or lint-free gloves use ESD-safe tweezers to gently lift the top battery adhesive tabs from the battery.
Important: Avoid touching the TrueDepth cameras and nearby components.



7. Hold down the battery with one hand. With the other hand, use the ESD-safe tweezers to grasp one battery adhesive tab and slowly pull it toward the top of the device. Twist the tweezers to wrap the battery adhesive tab around it. As the battery adhesive strip extends, continue to twist and slowly pull it with the tweezers. Remove tabs from right to left.
Important: Avoid touching the TrueDepth cameras and nearby components.
Note: If the adhesive strip breaks, then attempt to retrieve the strip with ESD-safe tweezers.

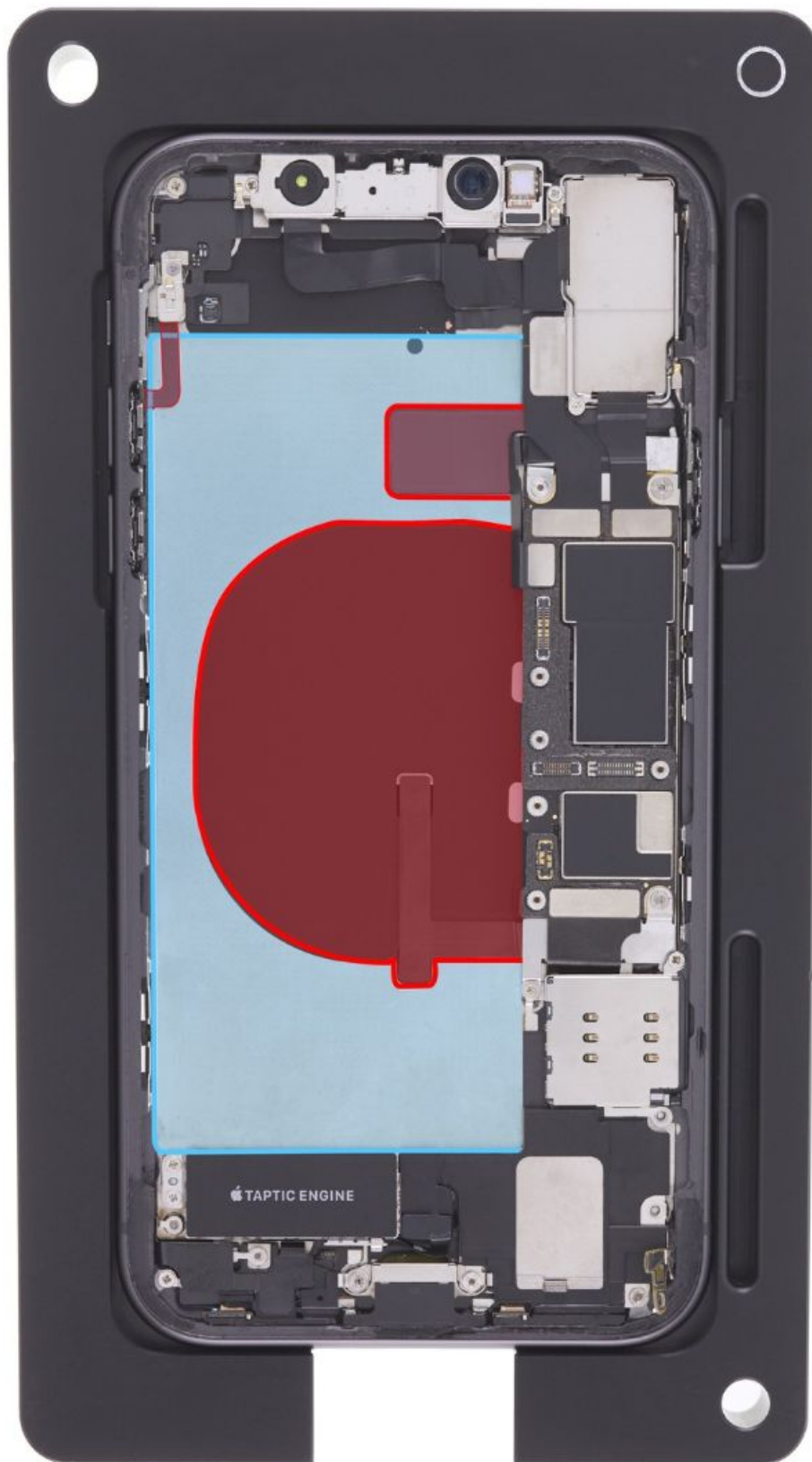


8. Repeat steps 6 and 7 with the remaining top battery adhesive strips.
9. Remove the battery from the enclosure.

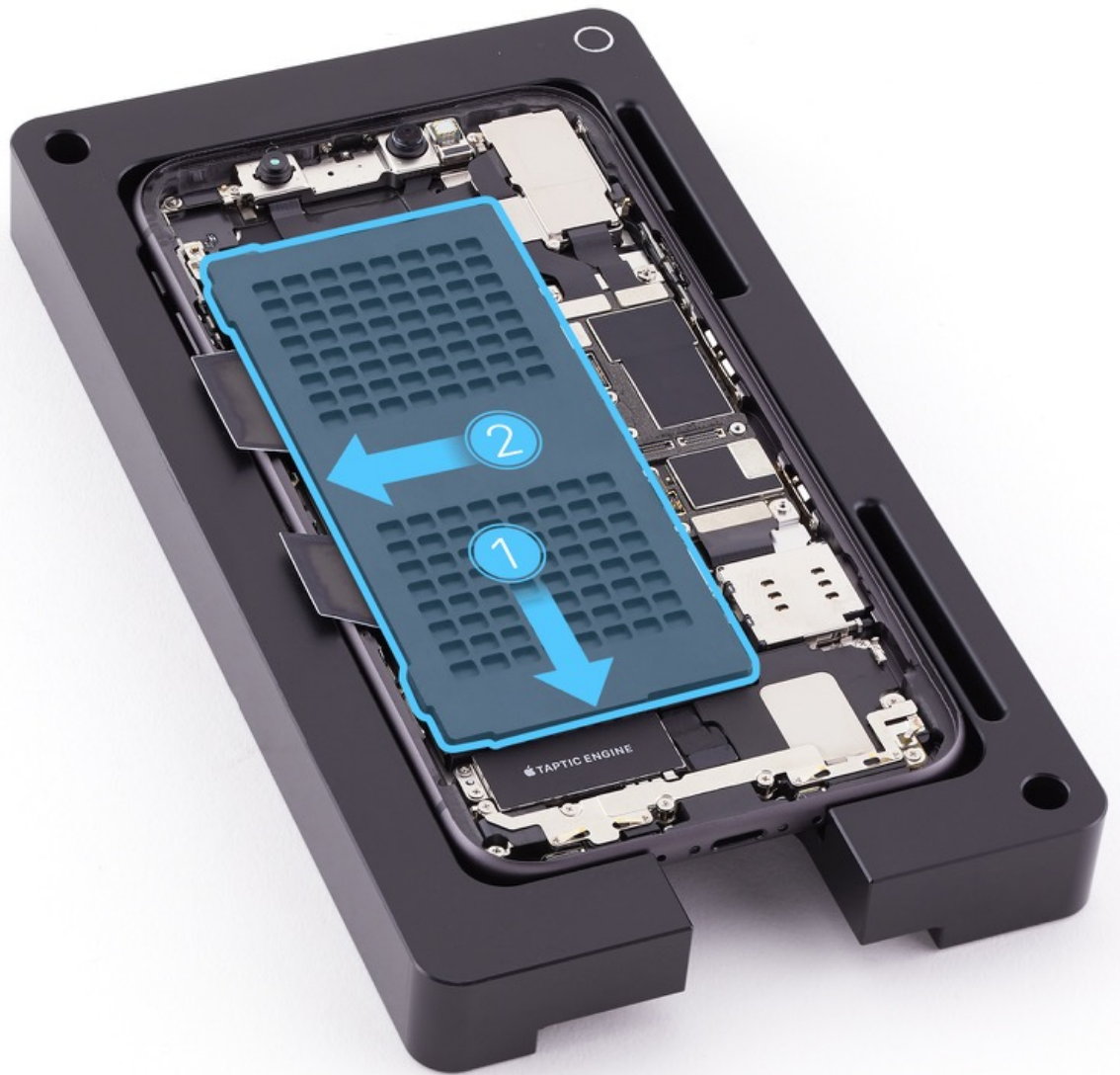
Steps For Reassembly

Post Repair

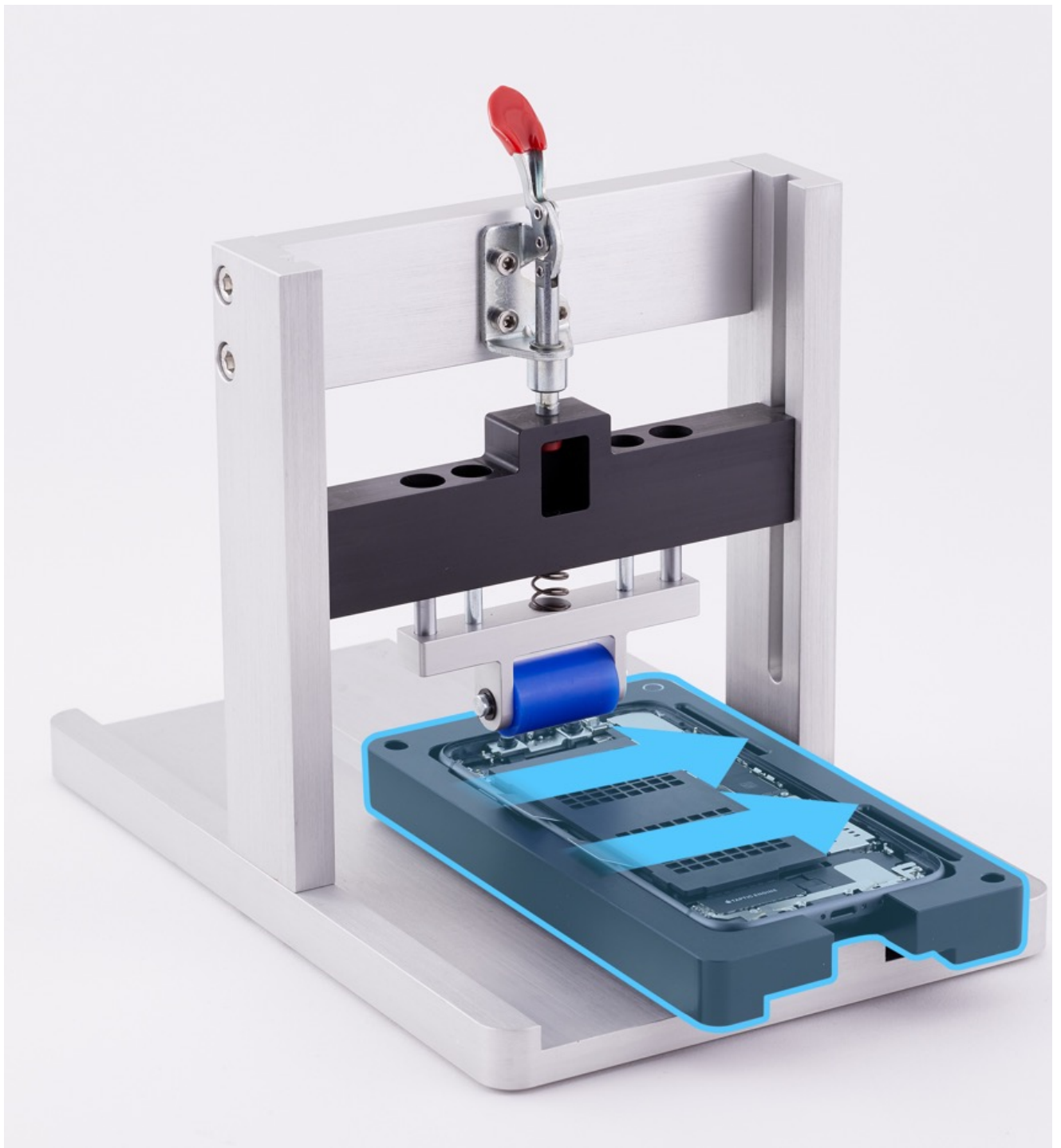
1. Reinstall the [Taptic Engine](#).
2. Use IPA wipes on the area marked in blue in the image below to remove any remaining adhesive from the enclosure underneath the battery.
Important: Avoid the wireless charging unit outlined in red as IPA wipes may damage the Mylar.



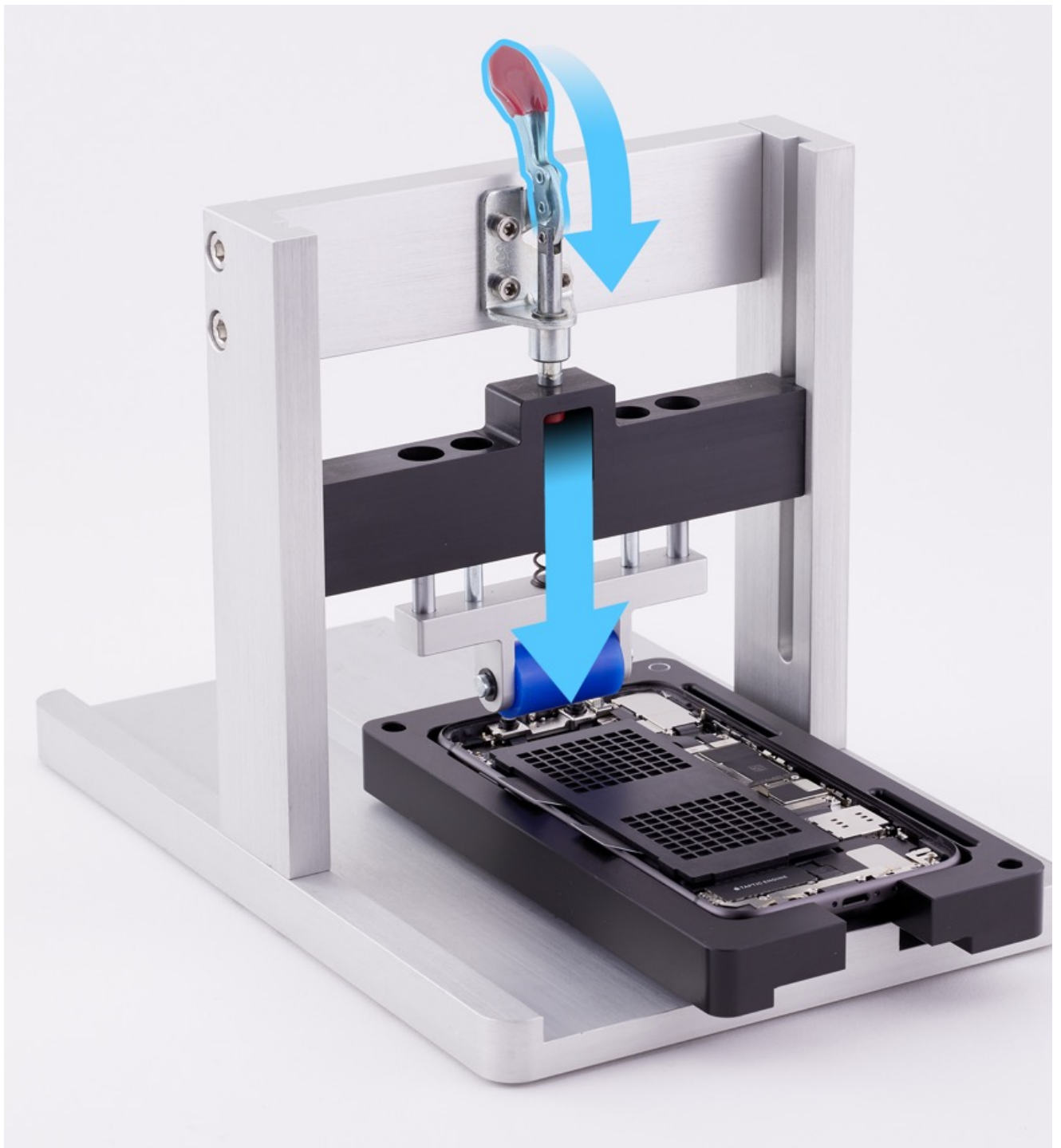
3. Peel the pink release liner from the battery to expose the adhesive that will attach to the enclosure. Do not remove the protective cover.
4. Position the battery in the enclosure without adhering it to the enclosure. Align the battery with the Taptic Engine and speaker (1) and then against the left edge of the enclosure (2). Then lower the battery into the enclosure.



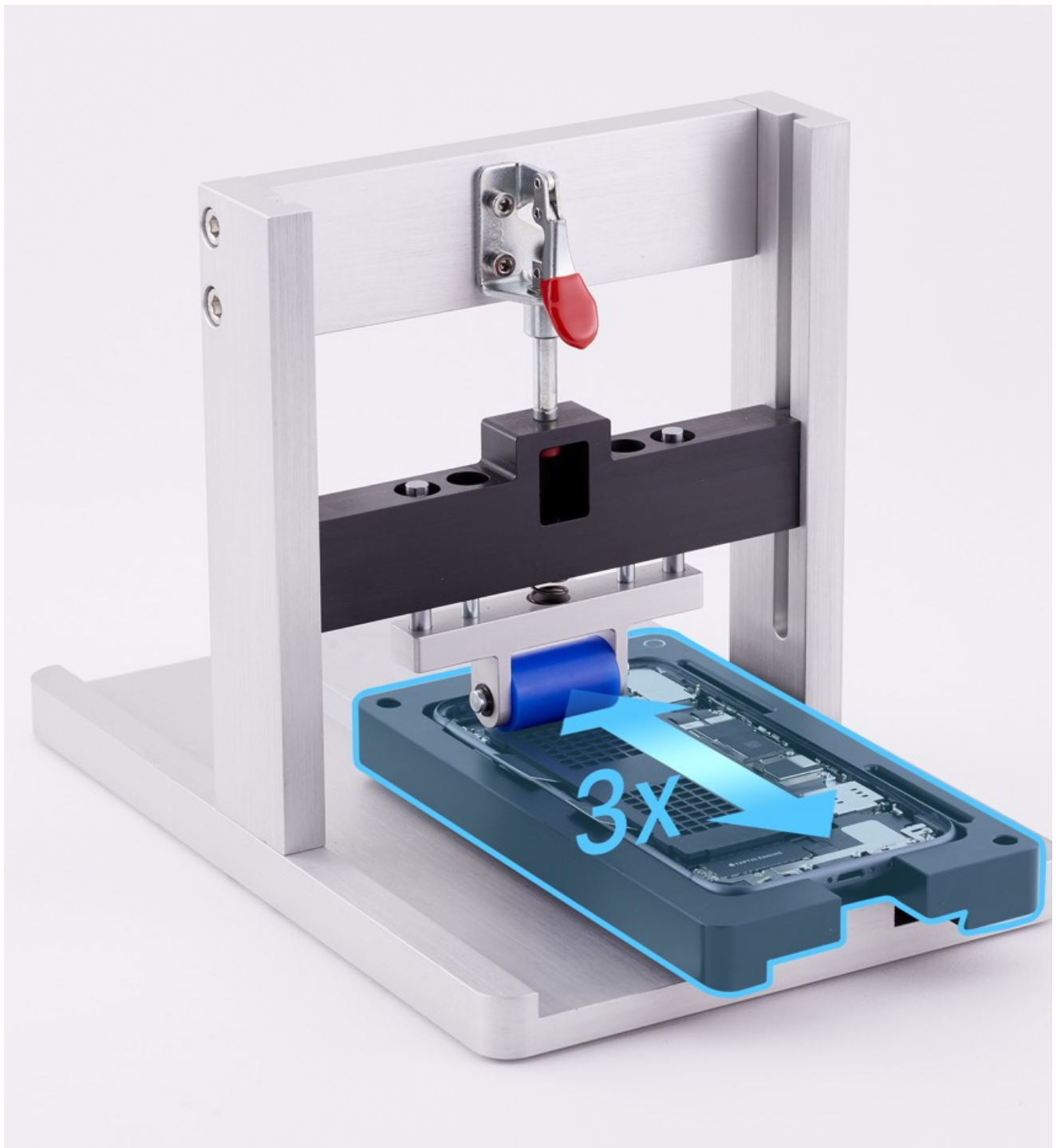
5. Place the iPhone and the repair tray into the battery fixture. Align the left slot on the repair tray with the pin on the fixture.



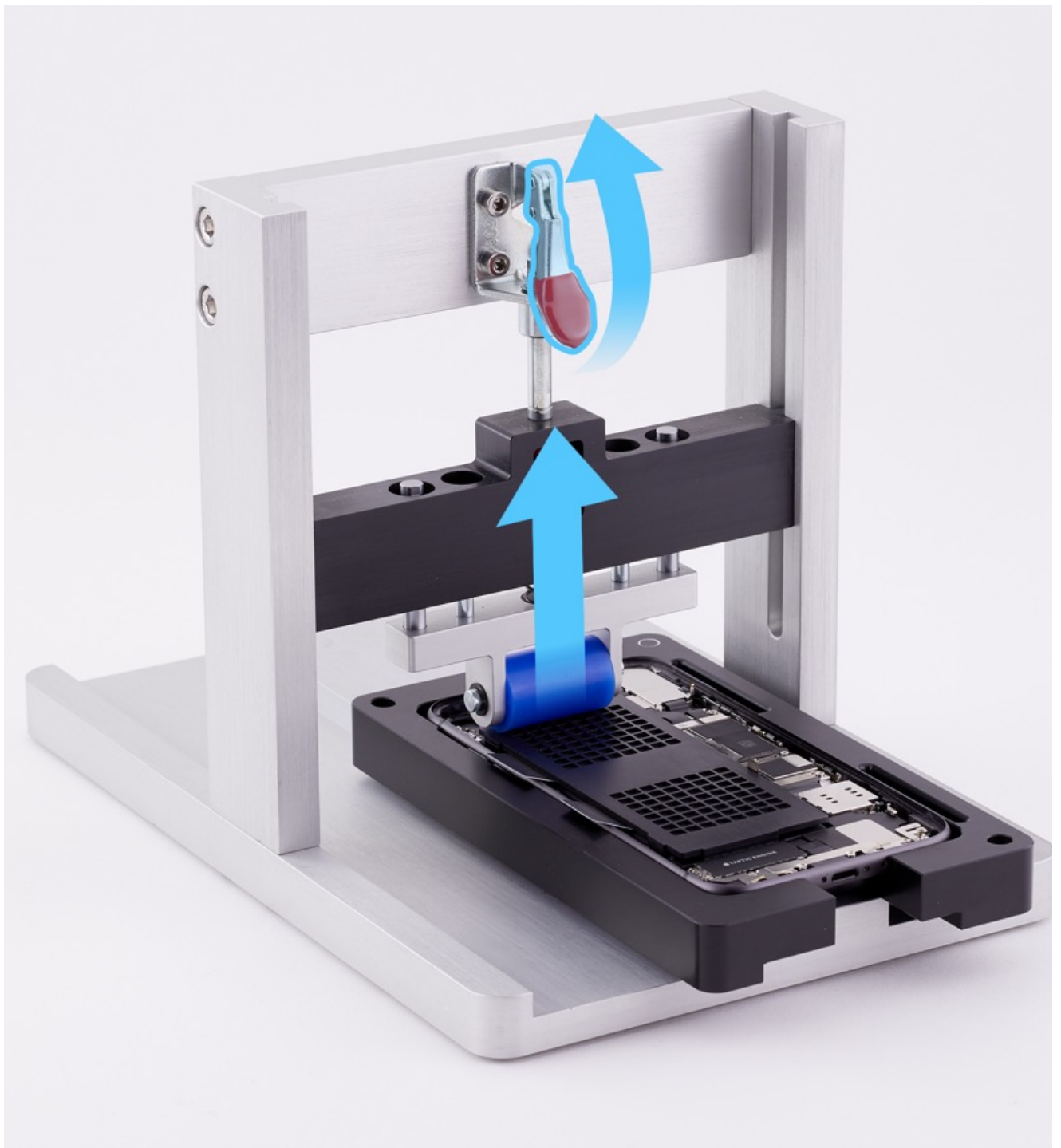
6. Lower the red lever to move the pressure roller into place above the iPhone battery.



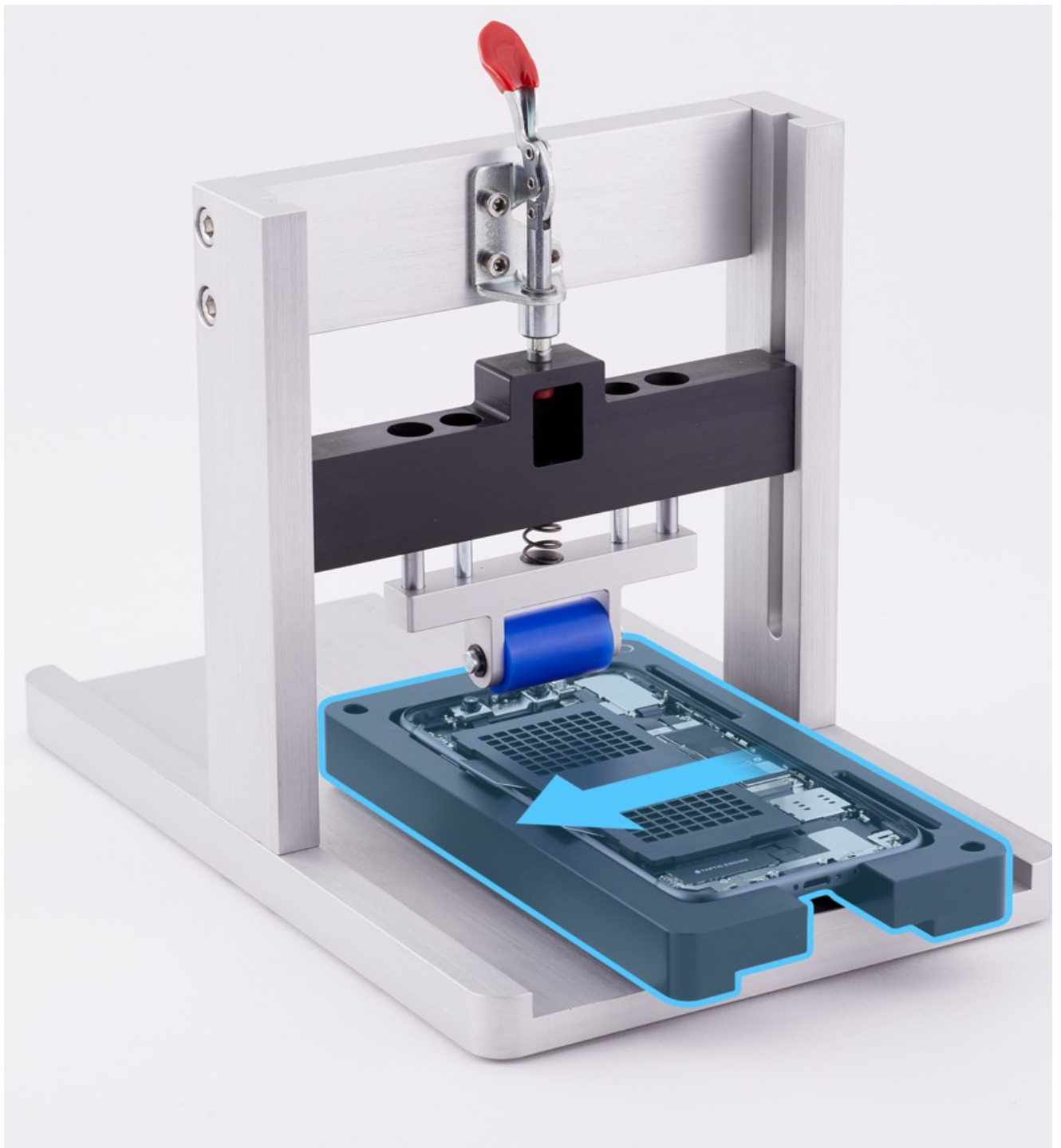
7. Slide the repair tray back and forth through the battery fixture three times to adhere the battery to the enclosure.



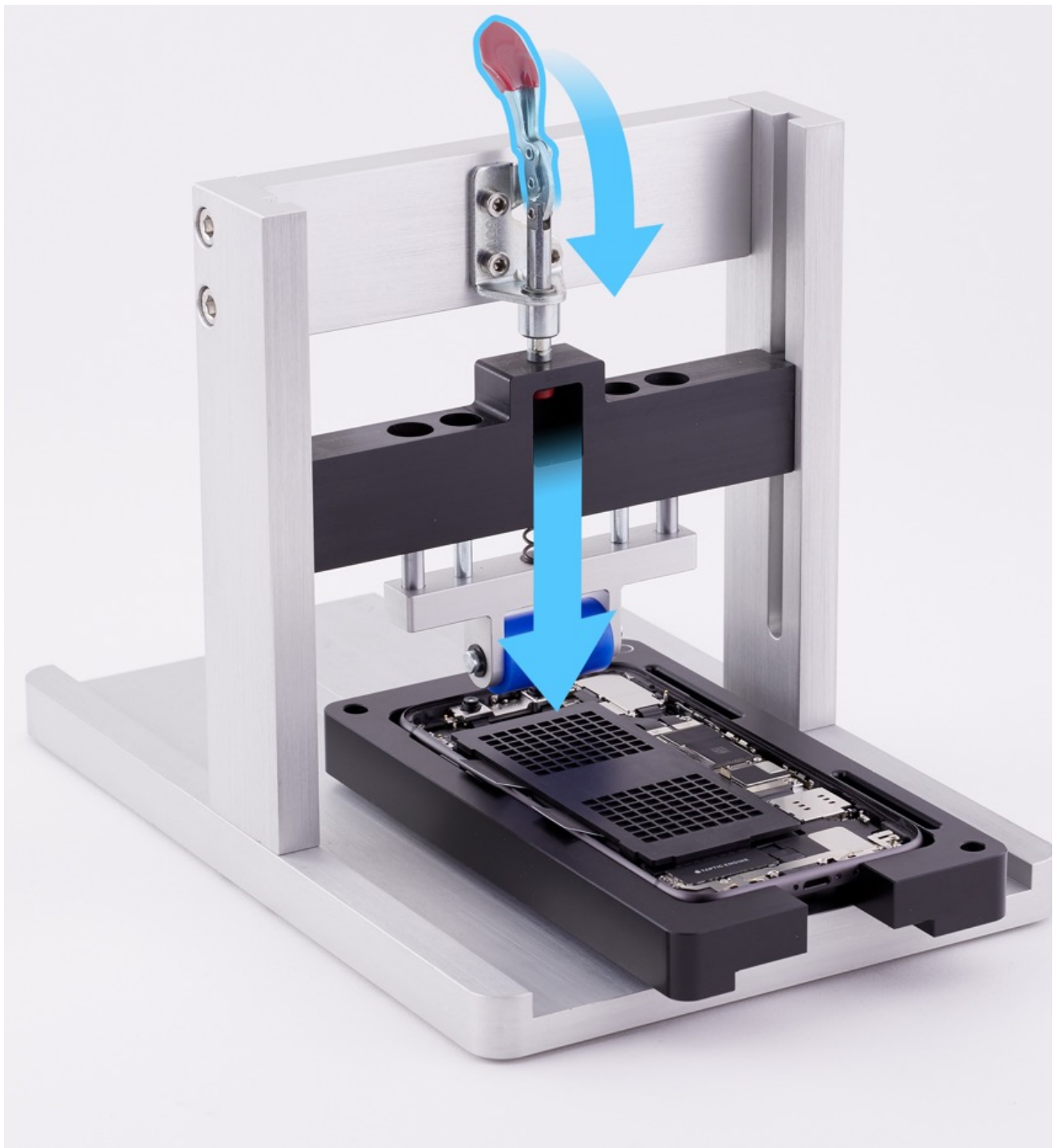
8. Raise the red lever.



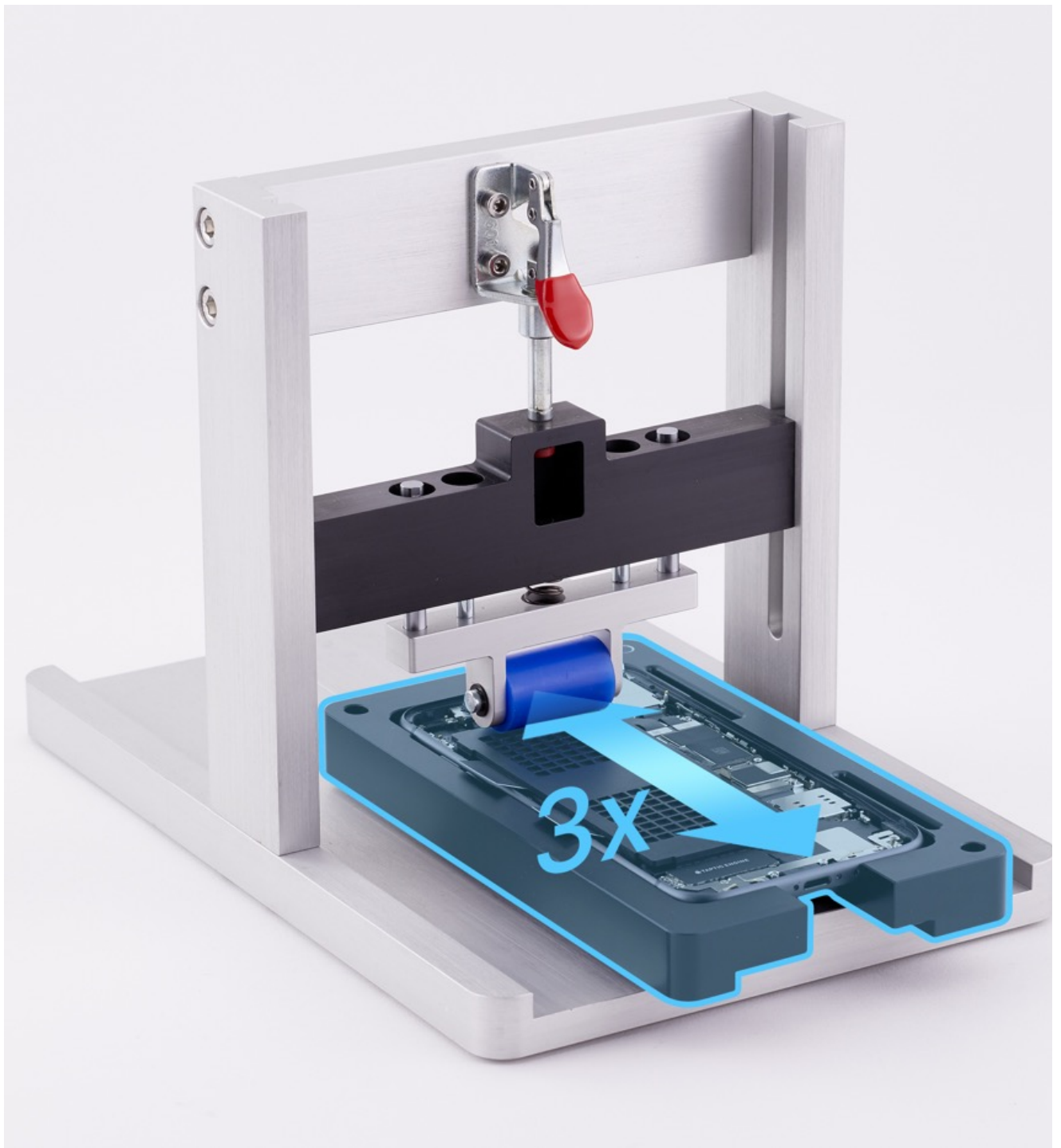
9. Move the repair tray to the right slot.



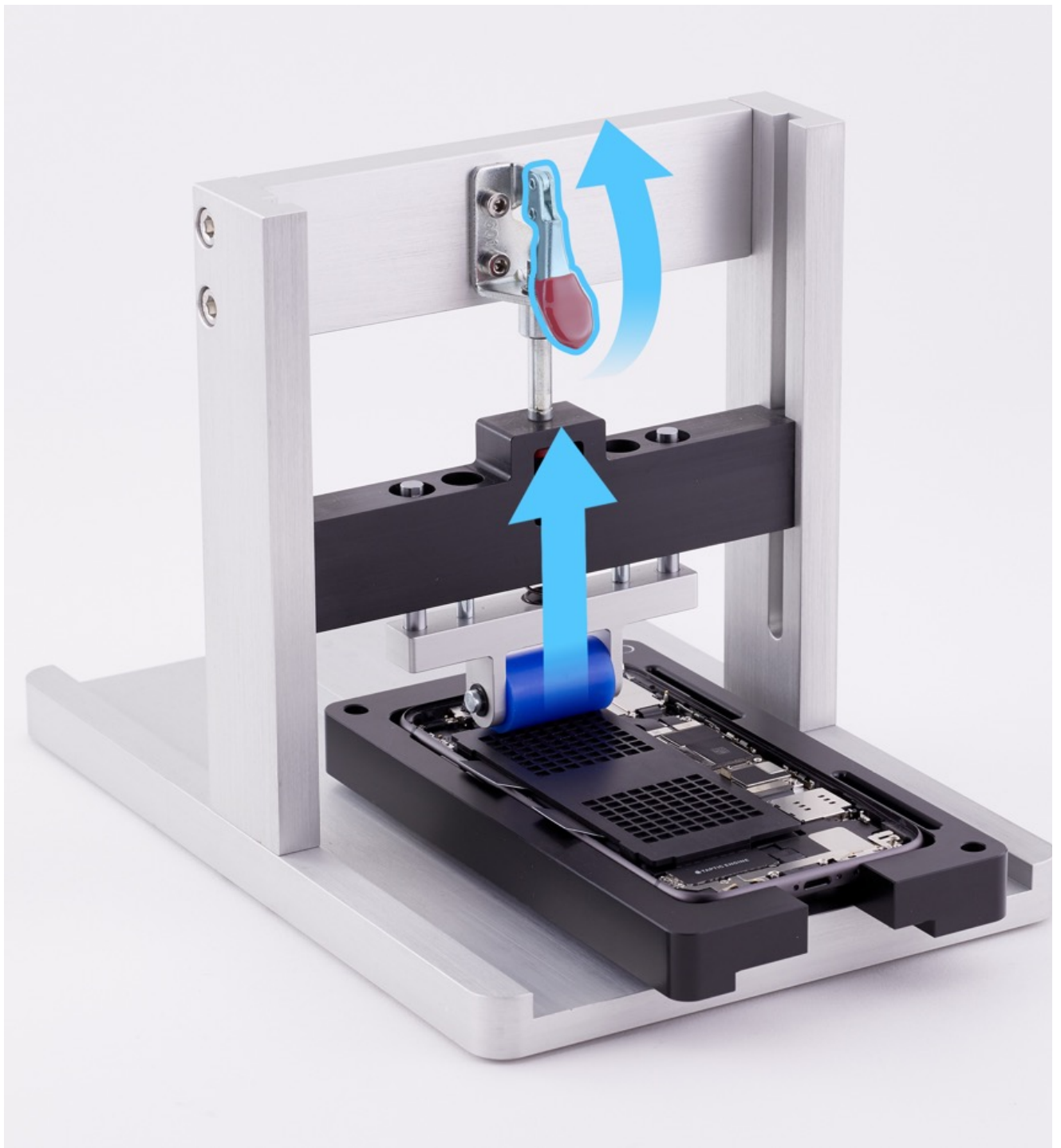
10. Lower the red lever.



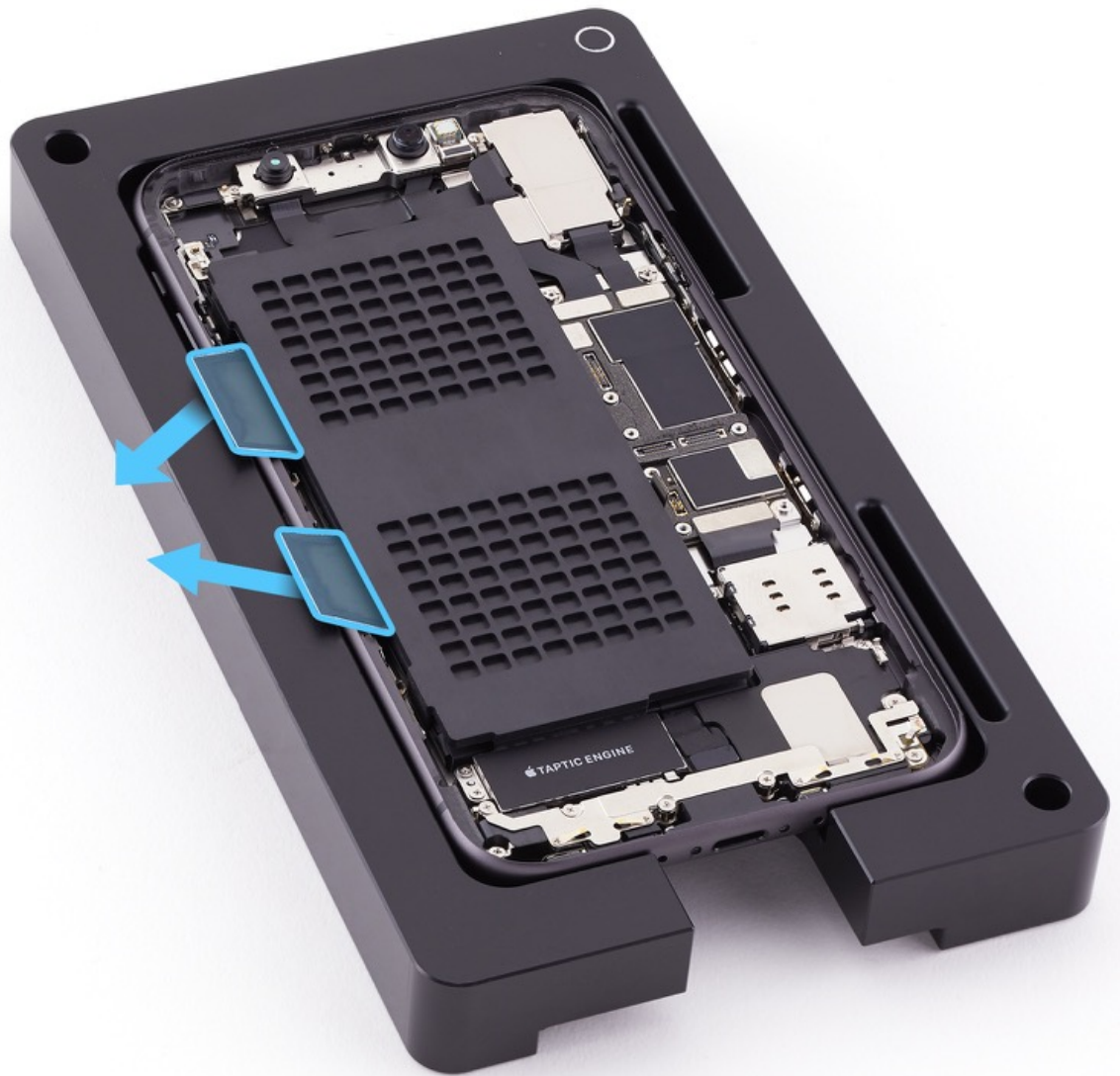
11. Slide the repair tray back and forth through the battery fixture three times to adhere the battery to the enclosure.



12. Raise the red lever. Remove the repair tray from the fixture.



13. Pull the release tabs on the protective cover in a diagonal direction and remove the cover from the battery. Do not apply pressure over the tab that you are releasing.
Important: Before you remove the battery cap, be sure you have performed steps 5 through 12.



14. Follow the reassembly steps in [Open Device](#).

15. Gently shake the iPhone and listen for a battery rattling sound. If the battery is moving, then [open device](#) and replace the battery with a new battery.

Important: Before you remove the battery cap, be sure you have performed steps 5 through 12.

Post Repair

1. After a battery replacement, the device must be configured with the new battery through System Configuration in AST 2. Follow these steps.

- Be sure the part number of the battery has been entered correctly and saved in your repair system.
- Create a diagnostic session in AST 2 using the iPhone serial number.
- The diagnostic suites list will populate and "System Configuration" will be grayed out. To make System Configuration available, start up the iPhone in Diagnostics Mode.
- Select "System Configuration" from the list when it becomes available. System Configuration will run and configure the device with the new battery.

Important:

- If System Configuration remains grayed out and does not become available in the diagnostics list, check that the battery part number was added correctly, saved in your repair system, and the iPhone was started in Diagnostics Mode.
- If System Configuration is not performed, an "Important Battery Message" will pop up on the display. If that happens,

turn off the iPhone and perform the System Configuration at that time. When the iPhone is then turned back on, the message will pop up again but should go away within 15–20 seconds.

2. Run the recommended AST 2 diagnostic suites found in [Diagnostics Mode](#).
3. Check iPhone operation using the steps in [Functional Test](#).

iPhone Functional Test

The iPhone functional test determines the functional state of an iOS device before and after a repair. Before a repair, use the iPhone functional test to determine if additional service is needed. After a repair, for devices running 10.3 or later, use Diagnostics Mode to run the AST 2 Post-Repair Diagnostic to verify the device's functionality. Devices running iOS 10.2.1 or earlier should continue to use the functional tests listed in this article. **Note:** Some feature-specific tests may not apply to the device under test.

Attempt to repeat the original issue or issues reported by the user and verify that no new issues are present after opening the device. If the user is reporting battery issues, use AST 2 to test the battery. Confirm that the device is fully operational before returning it to the user. Use AST 2 diagnostics to assist in testing for reported issues.

Test the following components:

1. Charging
2. Cellular and Wi-Fi Connectivity, Video Playback, and Speaker Sound Quality
3. Bluetooth
4. Headset and Proximity Sensor
5. Bottom Mic, Speaker, and Receiver Sound Quality
6. Cameras, Rear Mic, and Front Mic
7. Multi-Touch and Accelerometer
8. Buttons, Switches, and Vibe
9. Ambient Light Sensor
10. Location Services
11. Touch ID (iPhone 5s and later, excluding iPhone X and later)
12. 3D Touch and Taptic Engine (iPhone 6s and later, excluding iPhone SE and iPhone XR)
13. Taptic Engine (iPhone XR only)
14. True Tone Display (iPhone 8 and later)
15. Face ID (iPhone X and later)

1. Test Charging

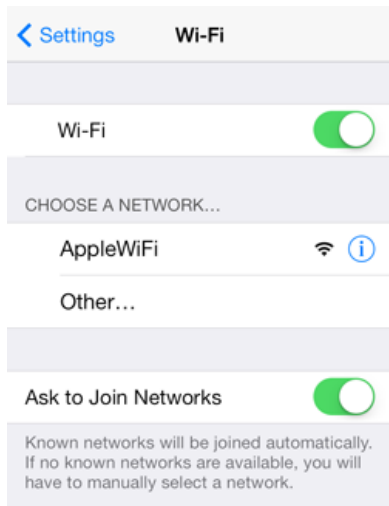
- a. Plug the USB charging cable into a USB power adapter, then plug the adapter into the wall.
- b. Connect the Lightning to USB Cable to the device. Verify that either a lightning bolt appears beside the battery icon in the status bar or a large battery icon appears on the lock screen.

For iPhones with wireless charging only (iPhone 8 and later):

- a. Run the Mobile Resource Inspector (MRI) diagnostic suite in AST 2 to test for the presence of wireless charging hardware.
- b. Connect the wireless charger to power. Use the power adapter that came with the accessory or a power adapter recommended by the manufacturer.
- c. Place the charger on a level surface or other location recommended by the manufacturer.
- d. Place the device on the charger with the display facing up. For best performance, place the device in the center of the charger or in the location recommended by the charger manufacturer.
- e. Verify that either a lightning bolt appears beside the battery icon in the status bar or a large battery icon appears on the lock screen.
- f. Charge the device for at least 15 seconds to ensure continuous charging.

2. Test Cellular and Wi-Fi Connectivity, Video Playback, and Speaker Sound Quality

- a. Run the Mobile Resource Inspector (MRI) diagnostic suite in AST 2 to test for the presence of Wi-Fi hardware.
- b. Check that the user's SIM card is installed. Ask the user to verify that their phone number is correct in Settings > Phone.
- c. Call an approved toll-free number to test phone call cellular connectivity and sound quality.
- d. Go to Settings > Wi-Fi and connect to a known-good 2.4GHz Wi-Fi network.



e. Play video from apple.com and verify that the video and audio play correctly. This will test the video playback and the speaker. For iPhone 7 and later, hold the device in landscape orientation. Go to Settings > General > Accessibility and adjust balance to the left, and then to the right. Be sure that Mono Audio is turned off. Replay the video to test the left and right speakers in isolation.

f. Repeat steps d and e while connected to a 5GHz network, if available.

3. Test Bluetooth

a. Run the MRI diagnostic suite in AST 2 to test for the presence of Bluetooth hardware.

b. Make a known-good Bluetooth device available locally. Check that the Bluetooth device is on and discoverable.

c. On the customer's device, go to Settings > Bluetooth.

d. Verify that Bluetooth is on. The device will search for nearby Bluetooth devices.



e. Pair the user's device with the Bluetooth device.

f. To unpair the device, tap the blue circle to the right of the device's name and then tap "Forget this Device."

4. Test Headset and Proximity Sensor

a. Open the Voice Memos app.

Voice Memos

Q Search

Tap the Record button to start a Voice Memo



- b. Tap the red circle to start recording.
- c. Place your hand over the top front of the device to cover the proximity sensor. The screen should go black.
- d. Remove your hand to uncover the proximity sensor. The Voice Memos screen should reappear.
- e. Connect EarPods to the device.
- f. Blow into the headset microphone to verify functionality.
- g. Tap the red stop button to end the recording.
- i. Tap the play button.
- j. Listen to the playback through the EarPods, and adjust the volume using the headset remote control.
- k. Make a test phone call with a known-good SIM and with full cellular signal strength for at least one minute. During the call, verify the sound quality of the EarPods and headset microphone.

5. Test Bottom Mic, Speaker, and Receiver Sound Quality

- a. Open the Voice Memos app.

Voice Memos

Q Search

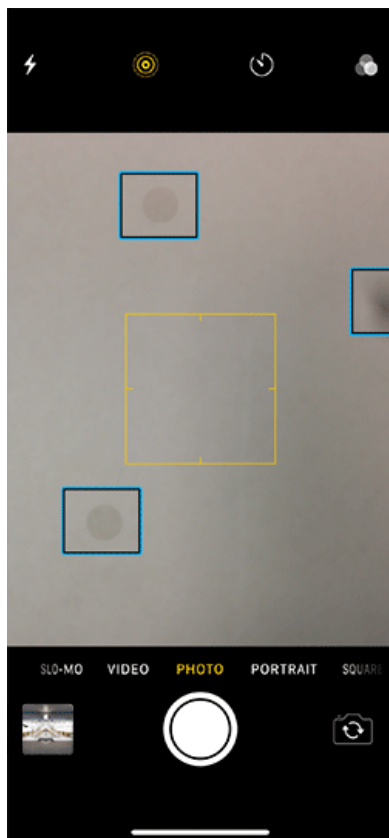
Tap the Record button to start a Voice Memo



- b. Record a short voice memo by tapping the red circle.
- c. When finished recording test audio, tap the red stop button.
- d. Tap the play button.
- f. Make a test phone call with a known-good SIM and with full cellular signal strength for at least one minute. During the call, verify the sound quality of the receiver, speaker, and microphone.

6. Test Cameras, Rear Mic, and Front Mic

- a. Run the MRI diagnostic suite in AST 2 to test for the presence of front and rear cameras.
- b. Remove any protective case that may interfere with the camera lens or flash.
- c. Download the [iPhone Camera Test Image](#) (PDF) and print out a color copy on unlaminated white paper. Do not modify, alter, or laminate the copy.
- d. Open the Camera app. Aim the back of the device at a clean sheet of blank white paper.
- e. Slowly move the device to inspect the preview image for anomalies, such as circles and dust spots.



f. Record video with the camera. Test the camera and rear mic by checking the recording for video and audio quality.

g. Take photos and check focusing with the camera.

- Start in landscape orientation and hold the device eight inches (~20 cm) from the test image.
iPhone 6 or later: The test image should quickly come into focus.
Other models: Once steady, the yellow focus square should appear briefly and the test image should be in focus.
- Keep the device in landscape orientation and hold the device three feet (~1 m) from the test image.
iPhone 6 or later: The test image should quickly come into focus.
Other models: Once the device is steady, the yellow focus square should appear shortly, with the test image eventually brought into focus.
- Rotate the device to portrait orientation and hold the device three feet (~1 m) from the test image.
iPhone 6 or later: In a well-lit room, the test image should stay in focus as you rotate. If the room is not well lit, the yellow focus square may appear. The image should not jump around or be severely out of focus during rotation.
Other models: Once the device is steady, even though the test image is already in focus, the yellow focus square may still appear in the preview indicating that the camera is trying to refocus. This is normal. Once the focus is complete, the test image should still be in focus.
- Keep the device in portrait orientation and hold the device eight inches (~20 cm) from the test image.
iPhone 6 or later: The test image should quickly come into focus.
Other models: Once the device is steady, the yellow focus square should appear shortly, with the test image eventually coming into focus.
- Verify that the primary colors are representative of the printed test image and that there are no dark spots near the edges of the photo.

h. Change the focus area and set the exposure: The yellow square on the screen shows the area where the camera is focusing the shot. Tap the screen to focus on the circle of the test image.

i. Turn on the flash.

- If possible, take the photo in a dim or darkened area to show where the flash is lighting.
- Check that the flash is lighting the circle in the test image and that the flash is not shifted to one side.

j. Pinch the screen, then drag the slider at the bottom of the screen to zoom in or out.

k. Touch the icon to select the FaceTime or TrueDepth camera. Repeat steps d through i (above) to test the

FaceTime or TrueDepth camera, front mic, and the Retina Flash. **Note:** The FaceTime or TrueDepth camera does not zoom, and only has a flash on iPhone 6s, 6s Plus, SE, 7, 7 Plus, 8, 8 Plus, X, XS, XS Max, XR. The Retina Flash is only available in photo, portrait, and square modes. It may be easier to hold the printed test image in front of the iPhone to test the FaceTime camera.

Additional Testing for iPhone 5c and later:

Use the camera slow-motion mode to record short videos of the printed test image and verify video quality.

- a. Switch the camera to slow-motion mode and keep the device in either landscape or portrait orientation.
- b. Set to 1x zoom, hold the device eight inches (~20 cm) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.
- c. Stay in 1x zoom, hold the device three feet (~1 m) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.
- d. Tap 1x to switch to 2x zoom, hold the device three feet (~1 m) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.
- e. Stay in 2x zoom, hold the device 20 inches (~50 cm) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.

Adjust Rear Camera

The rear camera for iPhone 4, 4s, and 5 can become misaligned when removing and reinstalling the back cover (iPhone 4 and 4s) or the display assembly (iPhone 5). Adjustment can be made by gently pushing the camera module in the direction needed for proper alignment.

Important: Do not touch the lens of the camera with bare fingers. Only touch the surrounding area or use gloves to ensure debris or fingerprints are not transferred to the camera lens.

Clean Rear Camera

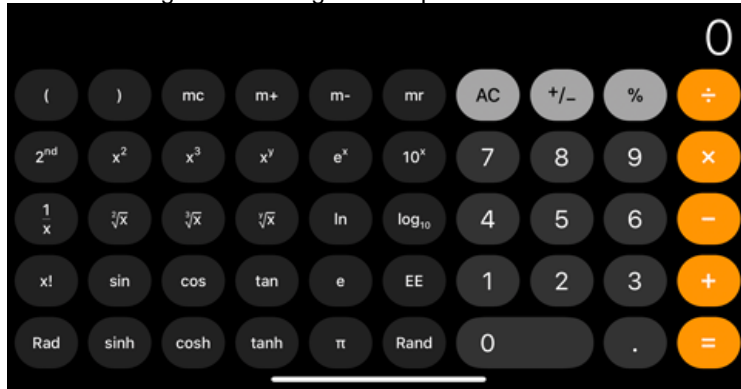
Check the rear camera lens for scratches that could affect image quality. Use a clean microfiber polishing cloth to remove smudges from the rear camera lens.

7. Test Multi-Touch and Accelerometer

- a. Run the following AST 2 diagnostic suites: use Multi-Touch to test for Multi-Touch response issues; use Unexpected Touch to test for overly sensitive touch response issues; use MRI to test for the presence of Multi-Touch and Accelerometer hardware.
- b. Open the Calculator app to test all but the top section of the screen. Hold the device in a vertical plane (upright), not horizontal (flat). Tap each button on the calculator to verify activity.



c. Rotate the device 90 degrees to the left to launch the scientific calculator. Tap each of the buttons. Rotate the device 180 degrees to the right and tap each of the buttons.



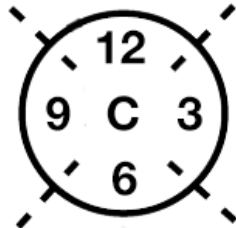
8. Test Buttons, Switches, and Vibe

a. Run each of the button and switch diagnostic suites in AST 2. Each suite tests the functionality of a specific button or switch.

b. Test the Home button using the following steps, depending on model:

iPhone 6s, 6s Plus, SE, and earlier

- Test clicks and double-clicks on the Home button.
- Press and hold the Home button for Voice Control or Siri.
- With the display off, press the center of the Home button and verify that the display turns on.
- Use the pointed end of a black stick to repeat the same test for the top, bottom, left, and right edges of the Home button (as shown by the numbers in the image below). The display should turn on when pressing any of these five locations.



- If no functional issues are found after testing the button with a black stick, use your finger or thumb to test for button stiffness, looseness, or mechanical symptoms.

iPhone 7, 7 Plus, 8, 8 Plus

- Test single-clicks and double-clicks on the Home button.
- Press and hold the Home button for Voice Control or Siri.
- With the display off, press the center of the Home button and verify that the display turns on.
- When pressing the Home button, verify that the haptic feedback simulates a physical button press.
- If the Home button does not respond in the above steps, test Touch ID functionality in Section 10 of this article.

c. Use your finger to repeatedly press the volume buttons and verify that the sound level indicator on the display is changing.

d. Use your finger to toggle the Ring/Silent switch back and forth and look for a bell icon on the screen.

e. Press the Ring/Silent switch and verify that the bell icon does not appear on the screen. **Note:** Do not toggle the switch.

f. Test the vibrate function.

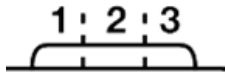
1. Go to Settings > Sounds & Haptics > Ringtone > Vibration.
2. Choose S.O.S.
3. Verify that the phone vibrates in the correct pattern.

g. Locate the Sleep/Wake or side button on the device, near the top right corner or right edge. (All iPhone models)

- Use the pointed end of a black stick to press the left side of the button (1) once, to put the device into sleep

mode (the display will turn off).

- Use the pointed end of a black stick to press the center of the button (2) once, to wake the device.
- Use the pointed end of a black stick to press the right side of the button (3) once, to put the device into sleep mode (the display will turn off).
- Use your finger to press the button again to wake the device.
- Use your finger to press and hold down the button until “slide to power off” appears on the screen.



h. If no functional issues are found after testing buttons with a black stick, use your finger or thumb to test for button stiffness, looseness, or mechanical symptoms.

9. Test Ambient Light Sensor

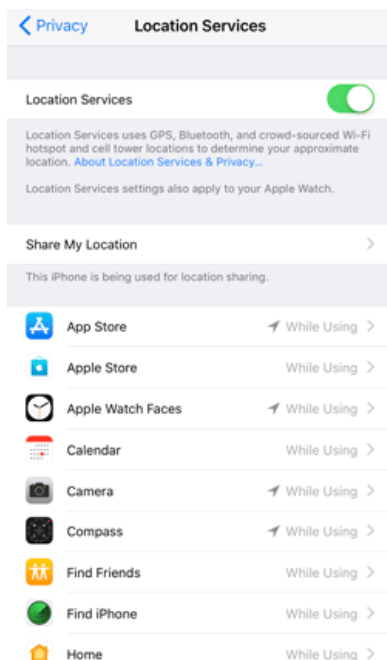
The ambient light sensor automatically adjusts the display brightness to an appropriate level for the current ambient light conditions. The ambient light sensor brightens the display when using the device in a bright light environment, and dims the display in low light.

- Run the MRI diagnostic suite in AST 2 to test for the presence of ambient light sensor hardware.
- Toggle Auto-Brightness off and then on in Settings > General > Accessibility > Display Accommodations.
- Press the Sleep/Wake button or side button to put the device into sleep mode.
- In a bright light environment, cover the top third of the front of the device to block the light (the base of your hand works well). The ambient light sensor is located near the receiver.
- Press the Sleep/Wake or side button to wake the device. While the ambient light sensor is covered, the display should be dim.
- Uncover the top of the device. After a few seconds, the display should return to its normal brightness.

10. Test Location Services

Location services depend on data service availability. Data services are subject to change and may not be available in all areas. This may result in unavailable, inaccurate, or incomplete maps, directions, or location-based information. Maps uses Wi-Fi hotspots to determine the most accurate location.

- Run the MRI diagnostic suite in AST 2 to test for the presence of gyroscope and compass hardware.
- Go to Settings > Privacy > Location Services and turn on Location Services.

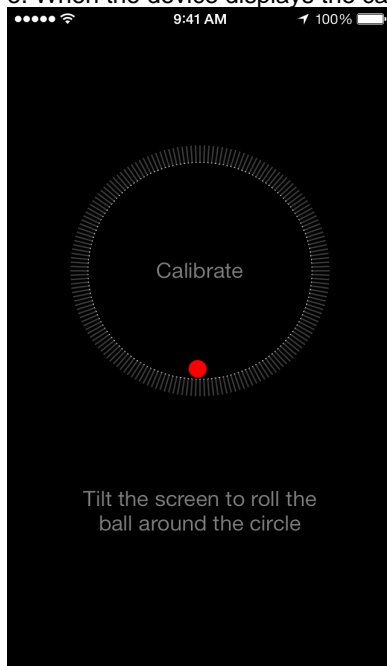


- Open the Maps app and tap the arrow in the lower left corner of the screen. Maps should display the device's current location.



d. Open the Compass app.

e. When the device displays the calibration alert, tilt the screen to roll the red ball around the circle.



f. Verify that when the iPhone is rotated, the heading shown on the screen changes according to the motion of the device.

11. Test Touch ID (iPhone 5s and later, excluding iPhone X and later)

This test should be performed with the user. Ensure that the Home button and your finger are clean and dry.

- Run the MRI diagnostic suite in AST 2 to test for the presence of Touch ID hardware.
- Go to Settings > Touch ID & Passcode and tap "Add a Fingerprint..."
- Hold the device as you normally would when touching the Home button.
- Touch your finger to the Home button and hold it there until you feel a quick vibration or you are asked to lift your finger. **Tip:** Do not press the button, just touch it lightly.
- Continue to touch and lift your finger slowly, making small adjustments to the position of your finger each time.
- Once the initial scanning is complete, you will be asked to adjust your grip in order to capture the edges of your fingerprint.

g. Hold the device as you normally would when unlocking it, touching the adjacent outer areas of your fingertip instead of the center portion you initially scanned.

h. Press the Sleep/Wake button or side button to lock the screen.

i. Press the Home button, Sleep/Wake button, or side button once to wake the device and keep your finger lightly on the Home button. The device will unlock when the fingerprint is recognized.

12. Test 3D Touch and Taptic Engine (iPhone 6s and later, excluding iPhone SE and iPhone XR)

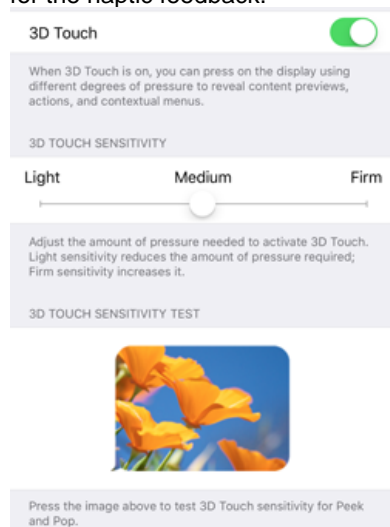
This test should be performed with the user.

Note: The iPhone must pass the Multi-Touch test above or the AST 2 Multi-Touch, Unexpected Touch, and MRI diagnostic suites.

a. Go to Settings > General > Accessibility > 3D Touch and confirm that the 3D Touch setting is enabled and sensitivity is set to Medium. 3D Touch must be enabled for 3D Touch and Taptic Engine functionality.

b. Go to Settings > General > Accessibility > Vibration to enable the Taptic Engine.

c. Use the 3D Touch Sensitivity Test to check the Peek and Pop functions. Look for the visual feedback and feel for the haptic feedback.



Peek



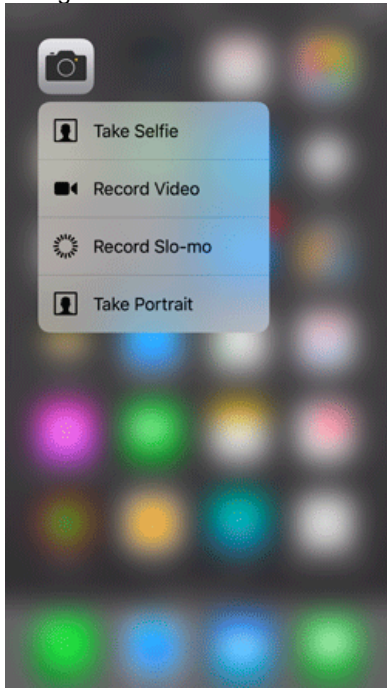
Pop



d. Press the Home button to return to the Home screen.

e. Hold the device with the display perpendicular to the floor.

f. Firmly press on one icon in the center of the display to test 3D Touch. Look for visual feedback. If the app does not support 3D Touch, then the area around the app icon will blur momentarily and provide haptic feedback then return to the Home screen. If the app supports 3D Touch, then a contextual menu will appear with a blurred background.



g. Feel for haptic feedback when pressing the app icons.

h. Hold the iPhone with the display parallel to the floor and repeat steps f and g.

13. Test the Taptic Engine (iPhone XR only)

This test should be performed with the user to verify the Taptic Engine.

- a. Tap Ringtone in Settings > Sounds & Haptics
- b. Tap Vibration.
- c. Tap Rapid and verify the iPhone vibrates as expected.

14. Test True Tone display (iPhone 8 and later)

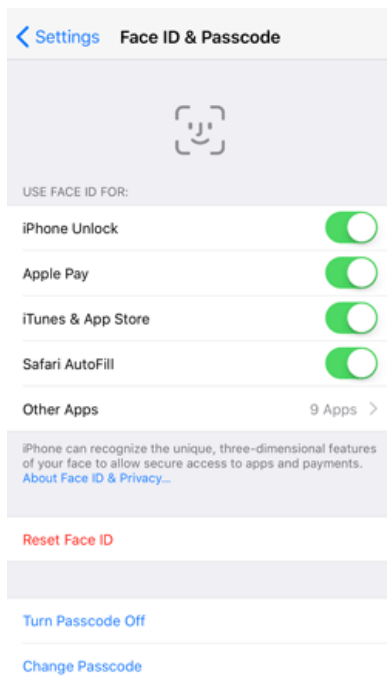
This test should be performed with the user to verify the True Tone display.

- a. Toggle True Tone off and then on in Settings > Display & Brightness
- b. Make sure that the tint of the white displayed changes when True Tone is toggled on and off.

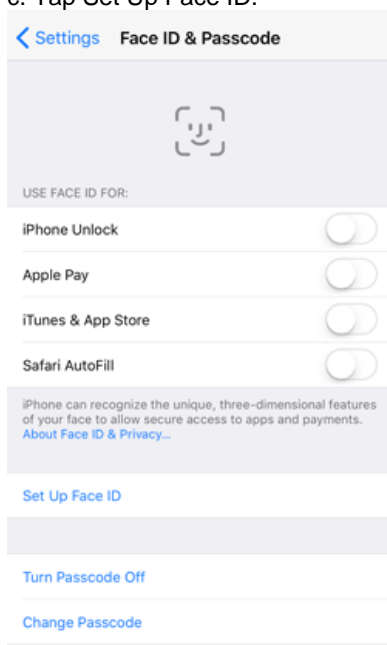
15. Test Face ID (iPhone X and later)

This test should be performed with the user to verify Face ID.

- a. Go to Settings > Face ID & Passcode
- b. Tap Reset Face ID if Face ID has been enabled.



c. Tap Set Up Face ID.



d. Ask the user to follow the onscreen instructions.

Cancel



How to Set Up Face ID

First, position your face in the camera frame. Then move your head in a circle to show all the angles of your face.

Get Started